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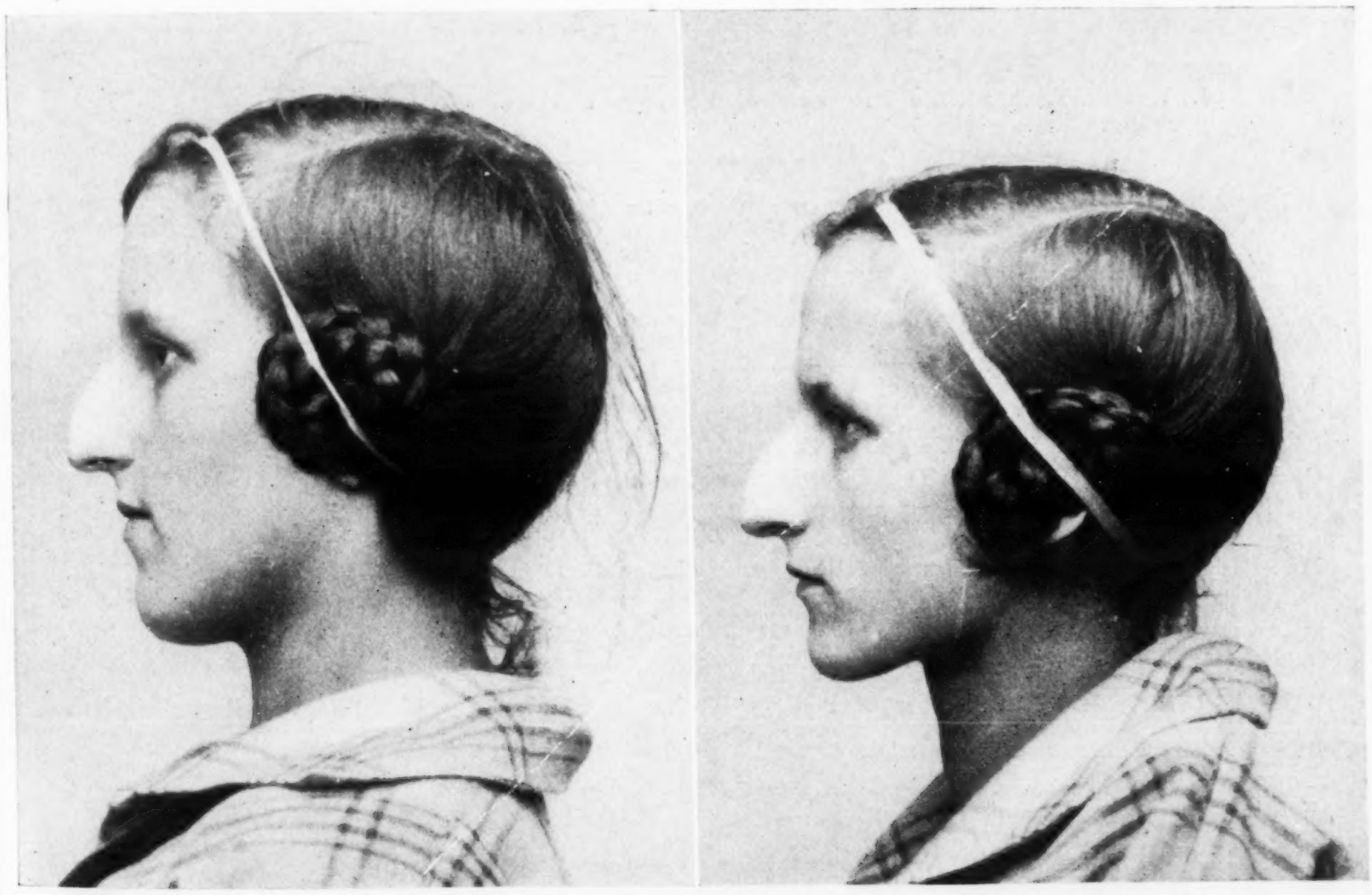
# The Journal of HEREDITY

*A monthly publication devoted to Plant Breeding Animal Breeding and Eugenics*



**UNLIKE IDENTICAL TWINS**

(See page 208)

**Mutations in a Haploid Datura**

**Night Blindness in Cattle**

**The Decline in Fecundity**

**Grades of Related Students**

**The International Genetics Congress**

MAY, 1927 Vol. 18, No. 5

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# Journal of Heredity

VOL. XVIII, No. 5 MAY, 1927

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**SEEDLINGS OF THE "CURLED" MUTANT——THE FIRST GENE MUTATION TO BE DISCOVERED IN A HAPLOID PLANT**

**Frontispiece**

Seed pan showing normal seedlings with flat cotyledons and seedlings of the gene mutant "curled." The latter have pale yellow waxy stems, as well as cotyledons which curl backwards like the moistened slit flower-stalk of a dandelion. Curled plants when adult are indistinguishable from normals.

The occasional viable eggs and pollen grains formed by a haploid contain the normal complement of twelve chromosomes, and produce a normal diploid plant, in which, barring mutations, the homologous chromosomes are genetically identical. The fact that mutations arise in haploid daturas, and with at least the normal frequency, is important evidence that the production of mutations is a phenomenon independent of hybridity.

# MUTATIONS IN A HAPLOID DATURA

## And Their Bearing on the Hybrid-Origin Theory of Mutants

A. F. Blakeslee
Gordon Morrison
A. G. Avery

*Carnegie Institution of Washington*
*Department of Genetics, Cold Spring Harbor, N. Y.*

IN an earlier paper in this Journal (May, 1924), the haploid was briefly described together with the more common of the other chromosomal mutant types in the Jimson Weed (*Datura stramonium*). It was shown that a haploid (1n) plant with 12 instead of 24 chromosomes characteristic of normal diploids (2n), cannot undergo a true reduction in the formation of its egg cells and pollen grains, since none of the 12 chromosomes have mates. The pseudo-reduction which takes place produces cells with 6 + 6, 5 + 7, 4 + 8 chromosomes and the other possible combinations as has been shown by Dr. Belling in the paper cited. Occasionally, however, no reduction is attempted and good egg cells and pollen grains are formed which may take part in the production of normal diploid (2n) offspring.

Since a haploid plant starts from a single 12-chromosome egg cell which develops parthenogenetically, all its cells, including the good eggs and pollen grains formed by "non-reduction," must contain identical chromosomes unless changes take place in them during the development of the plant. We have in the haploids, therefore, a unique opportunity of studying variation in a plant in regard to the first cell of which there can be no possible question of heterozygosity. The statement was earlier made that, barring new mutations, the progeny of a haploid should be all homozygous and genetically identical. It was fortunate that the reservation was made in regard to the possibility of new mutations, since they have in fact occurred directly from a haploid.

Haploids are not infrequent mutants in our cultures, over 50 having been identified since 1921, when we discovered in Line 1 our first haploid (1A). This 1A haploid [20745 (4)] has been kept in cultivation by grafts and cuttings and is the origin of Line 1A, in which we now have all our balanced chromosomal types, as well as all our primary and secondary (2n + 1) types.* It is the purpose of the present paper to record the genetic variations which have occurred within this line 1A and to suggest what bearing their occurrence may have upon the theory of the hybrid origin of mutants.

### Chromosomal Mutations

We have records of 393 indivuduals in the immediate progeny of the 1A haploid. Among these $F_1$ plants, there were 1 Globe, 1 Cocklebur, 2 Echinus, 1 Rolled, 3 Reduced, 3 Buckling, 1 Glossy and 6 small plants of undetermined type. This is a total of 12 (2n + 1) forms, or 3.05 per cent. No other chromosomal types were secured. In $F_2$'s or in later generations within Line 1A, there were 73 (2n + 1) forms in a total of 15,417 offspring from normal (2n) parents, or 0.47 per cent.

From (2n + 1) parents in Line 1A there were obtained 94 unrelated (2n + 1) forms in 8,505 offspring, or

*For descriptions and illustrations of these (non-disjunctional) types, see the article in the May, 1924, Journal.

1.11 per cent. Thus, the spontaneous occurrence of non-disjunctional types directly from a haploid (3.05 per cent) is considerably more frequent than that either from $(2n + 1)$ parents or from normal diploid parents (0.47).

The occurrence of $(2n + 1)$ types in relatively large numbers directly from a haploid shows that their formation is not necessarily connected with the reduction division, since a true reduction does not occur in haploids. They may be due to non-disjunction in the division following non-reduction, or might be brought about by somatic non-disjunction, either late in the generative tissues of the haploid or early in the development of the zygote.

### Gene Mutations

In contrast to chromosomal mutations, gene mutations are extremely rare in Datura. The number of gene mutants that have arisen spontaneously in our cultures during the last ten years can be counted on the fingers of two hands. Since most gene mutants and all that have appeared in our cultures are recessives, the first individual carrying the mutated factor will be a heterozygous "carrier" which will not show the new character. The number of mutations which will be recognized will depend, therefore, upon the number of parents which are tested by selfing. It has been earlier shown that if the parent which is selfed is heterozygous for a recessive which has normal viability, there is only one chance in a thousand of failure to recover at least one recessive in a progeny of 24 individuals. In testing the possible heterozygosity of individuals for new genes, we have usually sown sufficient selfed seed to secure a progeny of 30 individuals. A $(2n + 1)$ mutant type with a recessive gene in the set containing the extra chromosome will be expected when selfed to throw one recessive out of nine diploid offspring. Granting good viability, there is only one chance in a thousand of failure to recover a recessive if as many as 59 diploids are obtained in the offspring. Progenies of considerably more than this number have usually been obtained when seeds are sown from a $(2n + 1)$ parent. There is little likelihood, therefore, that we have missed any distinct gene mutant capable of segregating out from the plants tested.

In the immediate offspring ($F_1$ generation) from the 1A haploid, 173 plants have been tested by selfing. Of these, apparently 4 were heterozygous for a new gene mutant. Two of these mutant characters, curled and tricarpel, have been located in their respective chromosomes. The two others, not yet named, were discovered this last summer and are still under investigation. If we take into account only curled and tricarpel we have a minimum of 1.15 per cent of the $F_1$ plants tested heterozygous for a new gene, while if the other two new types are included, as they probably should be, the percentage rises to 2.31. In comparison with either of these figures it is of interest that there have been tested 363 normal $(2n)$ and $(2n + 1)$ individuals in the $F_2$ or later generations from the 1A haploid. None, however, were found heterozygous for a new gene. The mutants curled and tricarpel will be briefly described.

### The Gene Mutant "Curled"

The mutant "curled" was first discovered in a seed pan in which had been planted seeds obtained from selfing an individual in the $F_1$ generation from the haploid 1A. This $F_1$ parent was obviously heterozygous for the new character which appeared in the seed pan as the recessive in a 3:1 ratio.

The character was named curled from the peculiar rolling up of the young cotyledons as shown in the Frontispiece, lower side and to the left. When the seedings first come up they are pale yellow. The following day the cotyledons curl out and around like moistened strips from a dandelion

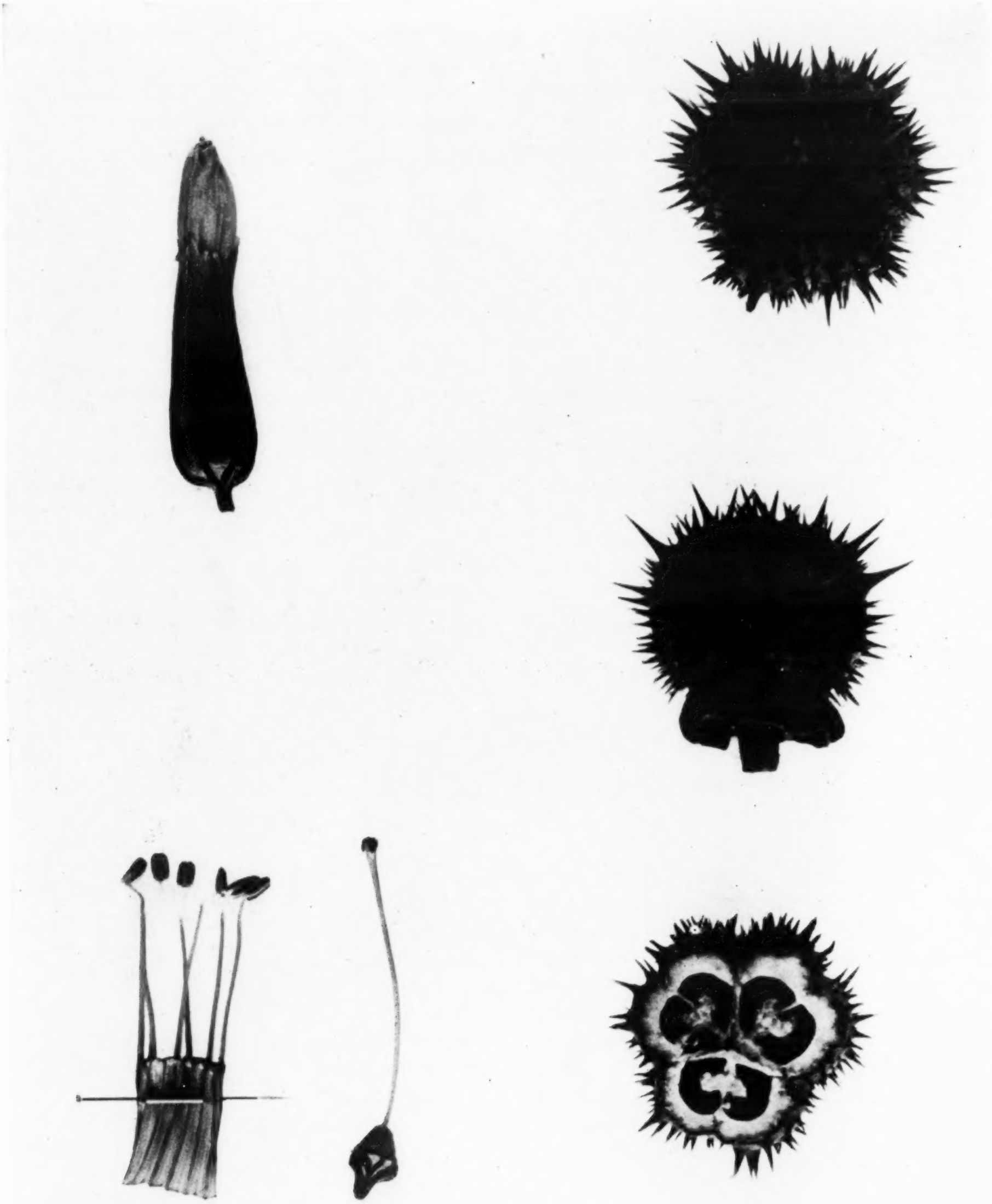
flower stalk. Gradually the cotyledons straighten out, generally showing withered areas, the color changes to green and later the stem takes on the reddish color characteristic of purple-flowered races. Whites have green stems, but when they are homozygous for curled they cannot be distinguished from purple curled plants until after the true leaves have begun to enlarge. In the young seedling stage, curled plants are brittle and weak in growth. Ants sometimes eat off the cotyledons and other injuries after germination as well as failure to germinate may cause a slight deficiency of curled in ratios where this character is involved. After its juvenile period of growth is over, however, curled plants are as vigorous as normals and in fact cannot be distinguished from normals by any criterion we have yet discovered. The gene curled belongs to the class of factors which produce visible effects only at a particular stage of development.

When, as is the case in $(2n + 1)$ types, there are three instead of two homologous chromosomes in one of the sets, random assortment of chromosomes will produce in the offspring trisomic rather than the familiar disomic ratios in respect to characters represented by factors in the trisome (the set of three homologous chomosomes). From the trisomic ratios thrown by Poinsettia when heterozygous for curled but by none of the other primary $(2n + 1)$ types, we can conclude that the gene for curled is located in the Poinsettia chromosome. By the same method of trisomic ratios, we had previously shown that the genes for purple and for white flower color were likewise in the Poinsettia chromosome. Linkage between the factors for curled and for white would therefore be expected. Since both characters show in the seed pan, there has been little difficulty in securing relatively large numbers in the ratios between them which indicate a cross-over value of about 12.5 per cent. By two different methods, therefore, it has been possible to show that the factors for curled and for white are located in the same chromosome.

### The Gene Mutant "Tricarpel"

The mutant tricarpel first appeared as recessive segregates in the offspring of a selfed $F_1$ from our haploid 1A. It has been named from the increased number of carpels in the capsule as shown in Figure 1. Capsules and flowers from a normal plant are shown in Figure 2. The adjoined table shows the number of carpels in capsules from three normal and from three tricarpel plants in a segregating culture. It will be seen that the number of carpels in capsules of tricarpel plants ranges from 3 to 4 while the number in capsules of normal plants rarely is more than 2. We have never noticed capsules with only two carpels on tricarpel plants grown out of doors, but on tricarpel plants in the greenhouse they have been observed occasionally. Along with the increase in number of carpels, there is an increase in the number of stamens, the lobes of the stigma, the divisions of the corolla, and the ridges on the calyx. Tricarpel buds are fatter than those of normals. It is not alone in floral organs, however, that tricarpel plants differ from normals. The leaves are narrower and often characteristically mottled with lighter patches. The stems are more slender, the plant is more frequently triforked, and the vigor of growth is considerably less (cf. Figure 3). So far as the duplication of carpels is concerned, we have in the mutant tricarpel an hereditary character similar in appearance to the extra-carpellary flowers occasionally found on normals which, however, have been shown by breeding tests not to be of hereditary significance.

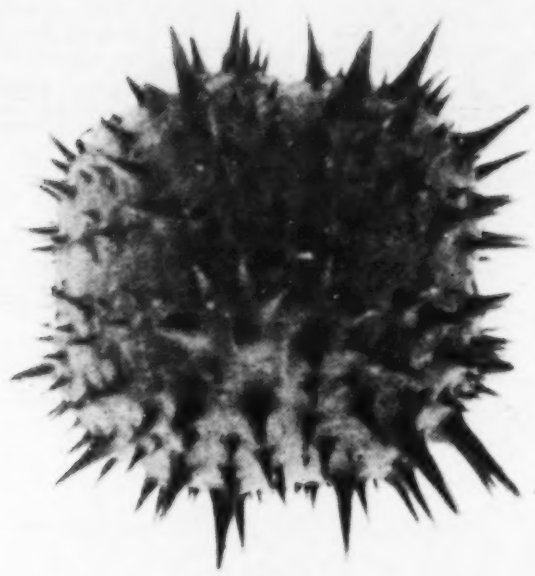
By the method of trisomic ratios used in locating the gene for curled, we have located the gene for tricarpel in the "Reduced" chromosome. In making these breeding tests, we backcrossed each primary $(2n + 1)$ type

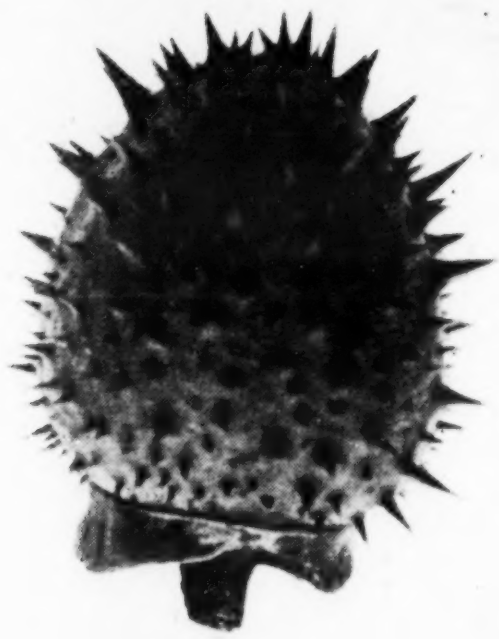


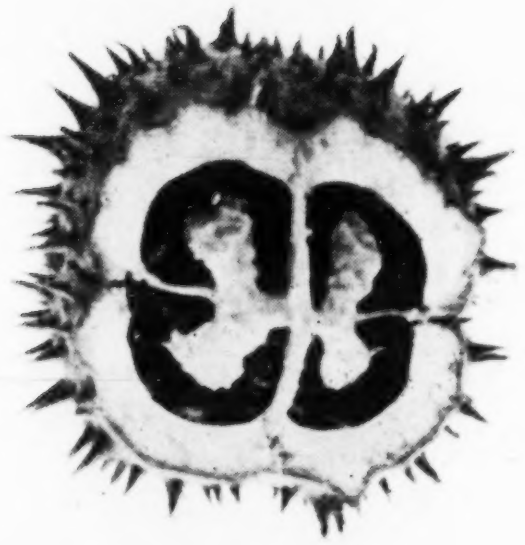
"TRICARPEL" FLOWERS AND FRUITS

**Figure 1**

Capsules, flowers and floral parts of the gene mutant tricarpel in comparison with those of a normal plant (on next page). The Jimson Weed normally has two carpels showing as two main divisions of the capsule, two lobes to the stigma, five stamens and five divisions to the calyx and the corolla. In the mutant tricarpel, all these numbers are increased. In distinction to the mutant curled, tricarpel plants are not distinguishable in the early juvenile stages of growth. For habit of growth, see Figure 3.







## NORMAL FLOWERS AND FRUITS

**Figure 2**

The internal structure and the shape of the normal flowers and fruit is distinctly different from that of "tricarpel."

**TRICARPEL AND NORMAL PLANTS**

**Figure 3**

Field-grown plants of the tricarpal mutant at left, and of a normal at right. Tricarpel plants in comparison with normals are more erect, have narrower stems which more frequently form three forks instead of two at the first branching, the leaves are narrower and the capsules are not ovate, but have the shape of diminutive chestnut burrs. For details of capsules and floral parts, see Figure 1.

to tricarpel, using the heterozygous parent both as a male (male backcross) and as a female (female backcross). The reciprocal crosses were found to be different, there always being a deficiency from the calculated number of tricarpels in the offspring where the heterozygote was the pollen parent. The cause of this difference between reciprocal crosses is being investigated by Dr. Buchholz.

### Summary and Discussion

We have shown that haploid 1A from our Line 1 in Datura has produced a high proportion (3.05 per cent) of $(2n + 1)$ chromosomal mutants in the $F_1$ generation from selfing.

The haploid has certainly twice and probably four times produced in the same $F_1$ generation a plant heterozygous for a new gene mutation. The appearance of two or four new genes in the 173 individuals in the $F_1$, but of none in the 363 individuals of $F_2$ or later generations from the IA haploid may not be significant statistically in suggesting a mutation percentage as high as 2.31 but the fact indicates that mutations are at least no more likely to occur in the later generations than directly in the homozygous haploid. Two of the new gene mutant types, curled and tricarpel, are briefly described and shown to be located in the Poinsettia and the Reduced chromosomes respectively.

The curled and tricarpel mutations probably occurred in the haploid, each in a single egg or pollen grain. If they had occurred earlier in somatic tissue they might have involved a bud and would have given rise to tissue homozygous for the new genes. If the new gene were tricarpel, the new character would have shown as a sectorial chimera. A "curled" sectorial branch on a haploid would not have been distinguishable but all the seeds from such a branch should have been homozygous for the new character. It seems likely, therefore, that the mutations occurred either in the gametes themselves or in cells genealogically not far removed from the gametes. The possibility is not ruled out of the

mutation having occurred in an early cell in the zygote. If the mutation occurred at a late stage in somatic tissue of the $F_1$ plant which was later shown to be heterozygous, some of its capsules might be expected to lack the gene in question. From the first heterozygous curled plant 11 individual capsules were tested, and they all threw 3:1 ratios. The plant was therefore probably heterozygous throughout. From the other $F_1$ plants that threw new gene mutants, fewer capsules were tested. It is obviously impossible to disprove the origin of these gene mutants in somatic tissue of the $F_1$ plant. It does not matter much, although the failure to find gene sectorial chimeras when chromosomal chimeras are relatively frequent in Datura might seem to argue for the mutation having taken place in the haploid. In any case, the gene mutations arose either directly in haploid tissue or in cells which came from the haploid and therefore should be presumably homozygous.

Whether the parent of our haploid 1A was the result of hybridization or not, could not affect the necessary homozygosity of the haploid nor, so far as can be seen, the homozygosity of its offspring. Those who emphasize the importance of hybridization in evolution are doing a service, since we believe hybridization has been a factor in bringing about the diversity found in nature. To say that mutations arise only because of previous hybridization, however, seems to be arguing beyond the evidence. The haploid in Datura seems to show that homozygosity does not hinder mutations in genes. But what genes actually are, to this question the final answer has not yet been given.

TABLE 1—NUMBER OF CARPELS IN CAPSULES OF THREE NORMAL AND OF THREE TRICARPEL PLANTS FROM THE SAME FRATERNITY

| Normals | | | Tricarpels | | |
|---|---|---|---|---|---|
| Plant No. | 2 Carpels | 3 Carpels | Plant No. | 3 Carpels | 4 Carpels |
| 2401 (2) | 103 | 5 | 2401 (1) | 49 | 16 |
| 2401 (3) | 116 | 1 | 2401 (4) | 25 | 11 |
| 2401 (5) | 119 | 0 | 2401 (6) | 28 | 16 |
| Totals | 338 | 6 | Total | 102 | 43 |

## Intelligence of School Children and Immigrants

### *Two Books on Mental Differences*

Both of these books* deal with the differences in intelligence among human beings. Both of them give critical discussions of intelligence tests, and both of them contain the results of original investigations on the measurement of intelligence. Doctor Wentworth expresses the opinion that " no one test is ever final," but that the tests when used intelligently and understandingly, in connection with a social and emotional study, "are the most important contribution to education which psychology has made."

The value of Doctor Wentworth's volume consists mainly in the analysis of individual cases. These include sixteen twins, eleven psychopathic children, twelve mentally deficient children, ten children with special abilities or disabilities, ten children of average intelligence, several family groups, and twelve Italians. Environmental factors, especially in early life, are held to be very important in moulding the personality of the child, but the author recognizes also the great importance of heredity. Doctor Wentworth's volume is a very human

*WENTWORTH, MARY M. Individual Differences in the Intelligence of School Children. Cambridge, Harvard University Press, 1926, pp. 162.

KIRKPATRICK, C. Intelligence and Immigration. Baltimore, Williams & Wilkins Co., 1926, pp. xiv + 127. Price $4.00.

document and will be a distinct help to those who are endeavoring to guide the development of the child.

Doctor Kirkpatrick's book on "Intelligence and Immigration" begins with some general considerations on intelligence, its relation to heredity and the possibility of its measurement. The author is inclined to give full weight to the influence of environment and training in developing intellectual power. At the same time, he appreciates the evidence that intelligence, like bodily traits, is dependent on hereditary factors. His attitude is both conservative and critical, and exhibits a tendency to be fair to the advocates of opposed views. He is under no illusions as to the imperfection of mental tests. There is, he believes, "a rough correspondence between the scores on tests of general intelligence, and they meet the important pragmatic test of predicting the limits of achievement under like conditions." Low score immigrants are undesirable from many points of view. They are more difficult to assimilate, and less valuable both as workers and citizens. They also tend to be unusually prolific and to outbreed better types.

Whether the studies are carried on upon army recruits or children in the schools, there is a striking agreement in the intelligence rating of the peoples of foreign countries. These differences in intellectual performance cannot reasonably be explained as the result of handicaps of language. The evidence points strongly to the important rôle played by heredity.

Chapters III and IV are concerned with the author's own studies of Americans, Finns, French-Canadians, and Italians in certain districts of Massachusetts. "Americans," he concludes, "are but slightly, if at all, superior to the Finns in intelligence. Both are far above the Italians, and the French-Canadians, taken as a whole, rank between these two extremes."

The author favors selective immigration based more on individual fitness than national origin. We should not admit any one who fails to measure up at least to the average standard of our own citizens. It is entirely feasible to make our immigration a means of improving instead of deteriorating the quality of our people.

There is a bibliography of 146 titles. Unfortunately the price, $4.00, even for these days of expensive books, seems quite out of proportion to the small dimensions of the volume.

*S. J. Holmes.*

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## Heredity and Insanity

HANDBUCH DER PSYCHIATRIE, *edited by* G. ASCHAFFENBURG; General Part, First Division, Third section, ERBIOLOGISCHE EINLEITUNG, *by* EUGEN KAHN. Pp. 73, price M.3.40. Wien, Frans Deuticke Verlag, 1925.

Dr. Kahn, who is a privatdozent in Munich and an associate of E. Rüdin, devotes most of his book to a general outline of heredity. The last 17 pages are given over to a discussion of the special problems of psychiatry, in which he is critical and extremely conservative, coming to no definite conclusion except that heredity plays an important part in the psychoses. There is a bibliography of 9 pages.

*P. P.*

# THE DIAGNOSIS OF IDENTITY IN TWINS

HERMAN WERNER SIEMENS

*University Dermatological Clinic, Munich, Germany**

THE discussion between H. J. Muller and Barbara Burks concerning the diagnosis of one-egg or identical twins leads me to give a brief account here of my own investigations on this subject. Accurate diagnosis of one-egg origin is an extraordinarily important procedure in the study of man's heredity; it is, as Miss Burks correctly remarks, "of immense value to geneticists and psychologists."

Since information concerning the relations of the fetal membranes is usually not obtainable and, even if it could be obtained, does not furnish the basis for such a positive diagnosis as has hitherto been supposed,† a diagnosis from *similarity* is the only alternative. All such methods would have to employ, as Prof. Muller says, "as their data the resemblance between the twins, as compared in some way with the resemblances between other sibs." It seems to me, however, that it is proper to choose the simplest and most direct method for this purpose. It consists in this, that one does not compare them with the likeness of *other relatives*, most of whom are not easily reached for a thorough examination, but that one simply compares the *totality of observed resemblances of one-egg twins with those of two-egg twins*.

The question, therefore, is: How great is the probability that, in a given trait, one-egg twins are not alike? and: how great is the probability that (in the same trait) two-egg twins are alike?

Such determinations are not at all difficult. The *majority* of all twins are either so completely alike, or so markedly different, that one can scarcely entertain a doubt as to their identity or non-identity, as the case may be.

These unquestioned one-egg, or two-egg, twins must be studied as to their resemblances in the traits concerned. Then one can easily form an opinion as to the probability involved in individual, questionable cases of identity or non-identity.

## Criteria of Identity

I might illustrate this by hair color. Among unquestionable identical twins, adult or of school age, real differences in hair color have not been observed. The probability that twins with different colored hair are from two eggs is therefore large. On the other hand, unquestionable two-egg twins (here in Munich) usually differ significantly in hair color. Of the last 50 pairs of such twins that I have studied, 34 had wholly different hair colors, nine showed moderate differences, which however, exceeded any I have ever found in (more than 100) certainly identical pairs. Only seven pairs showed such a resemblance in hair color, as to permit even a suspicion of identity.

Eye color is an even more favorable criterion, for in this respect have been found, at the most, only wholly insignificant differences. In the 50 pairs above mentioned I found 41 times decided differences, six times slighter differences, which yet have never been observed among one-egg twins, and only three times greater resemblance.

The probability that twins with identical hair *and* eye color are from two eggs would accordingly (in our population) be very slight. *In isolated cases* this would of course not suffice for diagnosis. Were we to base a diagnosis on only a character or two, we would fall into the error that the finger-print investigators have made in attempting, from the finger print patterns alone,

*Translated by Paul Popenoe.

†I have described in the *Archiv f. Gynackologie* a number of one-egg twins with separate and a number of two-egg twins with common fetal membranes.

THE M—— TWINS AT ONE YEAR OLD

**Figure 4**

The twins discussed in this article exhibit adult differences of such magnitude as to suggest that they are not identical. The pictures reproduced here show how much alike they were before one of them was taken sick in their tenth year. Below is a picture of the twins about two years later.

M—— TWINS THREE YEARS OLD

**Figure 5**

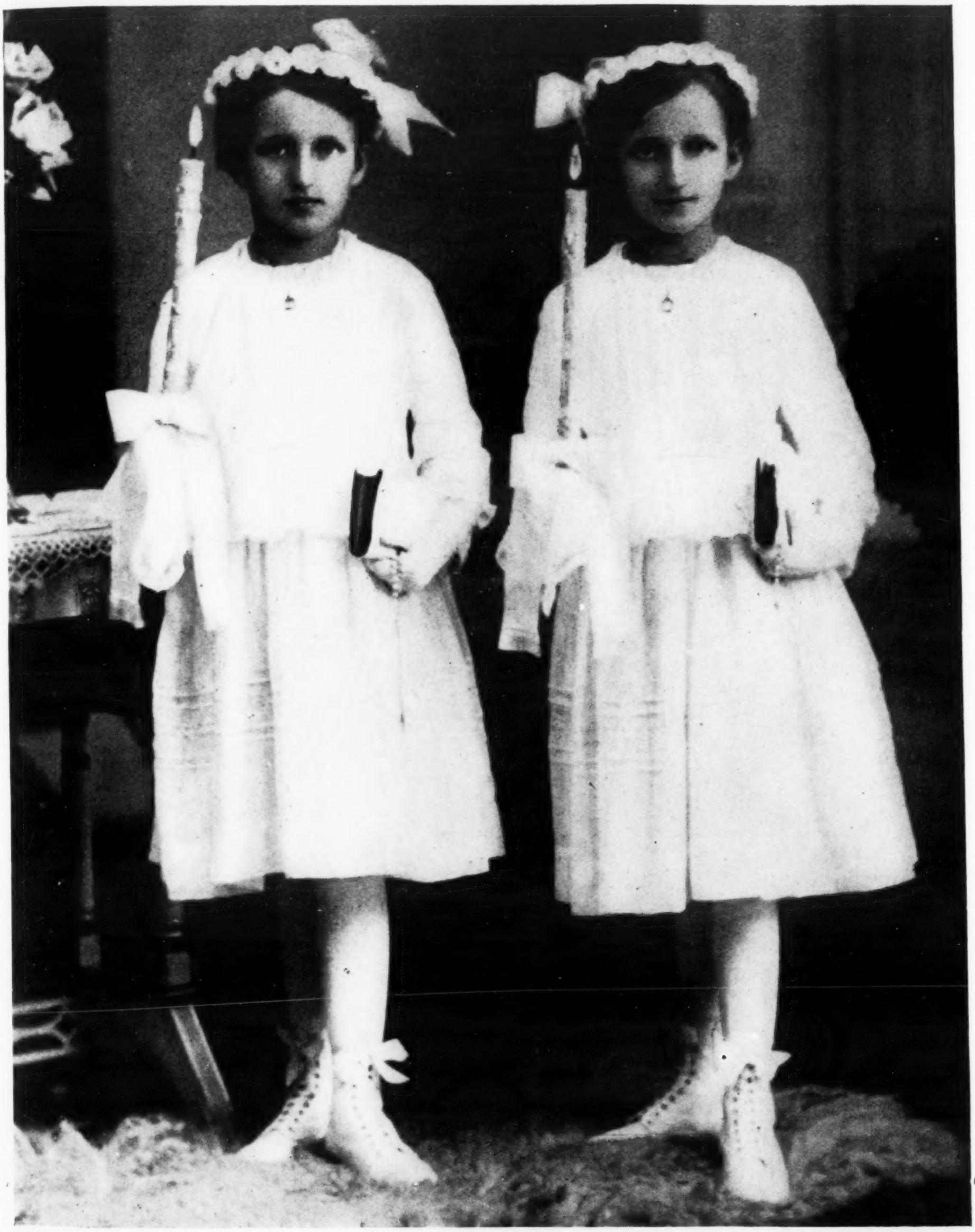
to make accurate diagnosis of genetic identity. The principle of the diagnosis of identity must rather be to test the resemblance of *as many traits as possible.*

For this purpose I have worked out a *scheme* which I have found useful during many years, and *which ought to be borne in mind by all investigators who publish information regarding important cases of twinning.* It is made up thus:

A. Traits which agree in one-egg twins almost always and almost completely; in two-egg twins only rarely:

1. Hair color and form.
2. Eye color.
3. Skin color.
4. Downy hair of the body.

B. Traits which vary only within narrow limits, among one-egg twins; and which usually vary more widely among two-egg twins:



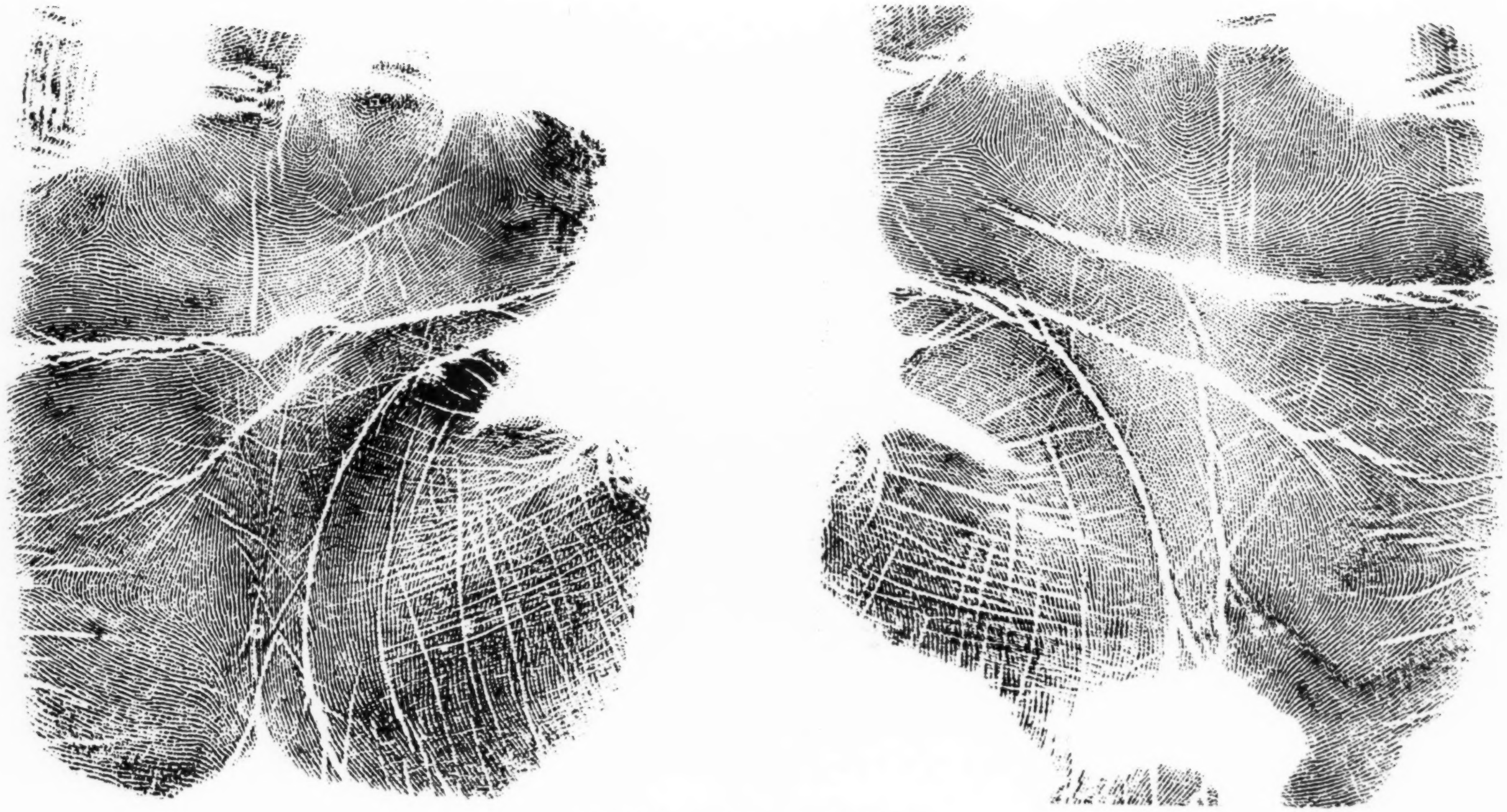
## IN THEIR TENTH YEAR

**Figure 6**

The twins are still about the same height and apparently do not differ much in weight. Six years later Sophia was 12 centimeters (4.8 inches) taller than Hilda.

HILDA'S PALM PRINTS

Figure 7



**SOPHIA'S PALM PRINTS**

**Figure 8**

The palm prints are not identical, but the similarities are so striking as to be strong evidence that these are monozygotic twins.

HILDE M— RIGHT

SOPHIA M— RIGHT

HILDE M— LEFT

SOPHIA M— LEFT

THE FINGERPRINTS ARE VERY SIMILAR

**Figure 9**

Here again similarities strengthen the probability of identity. The prints of the thumbs are remarkably alike.

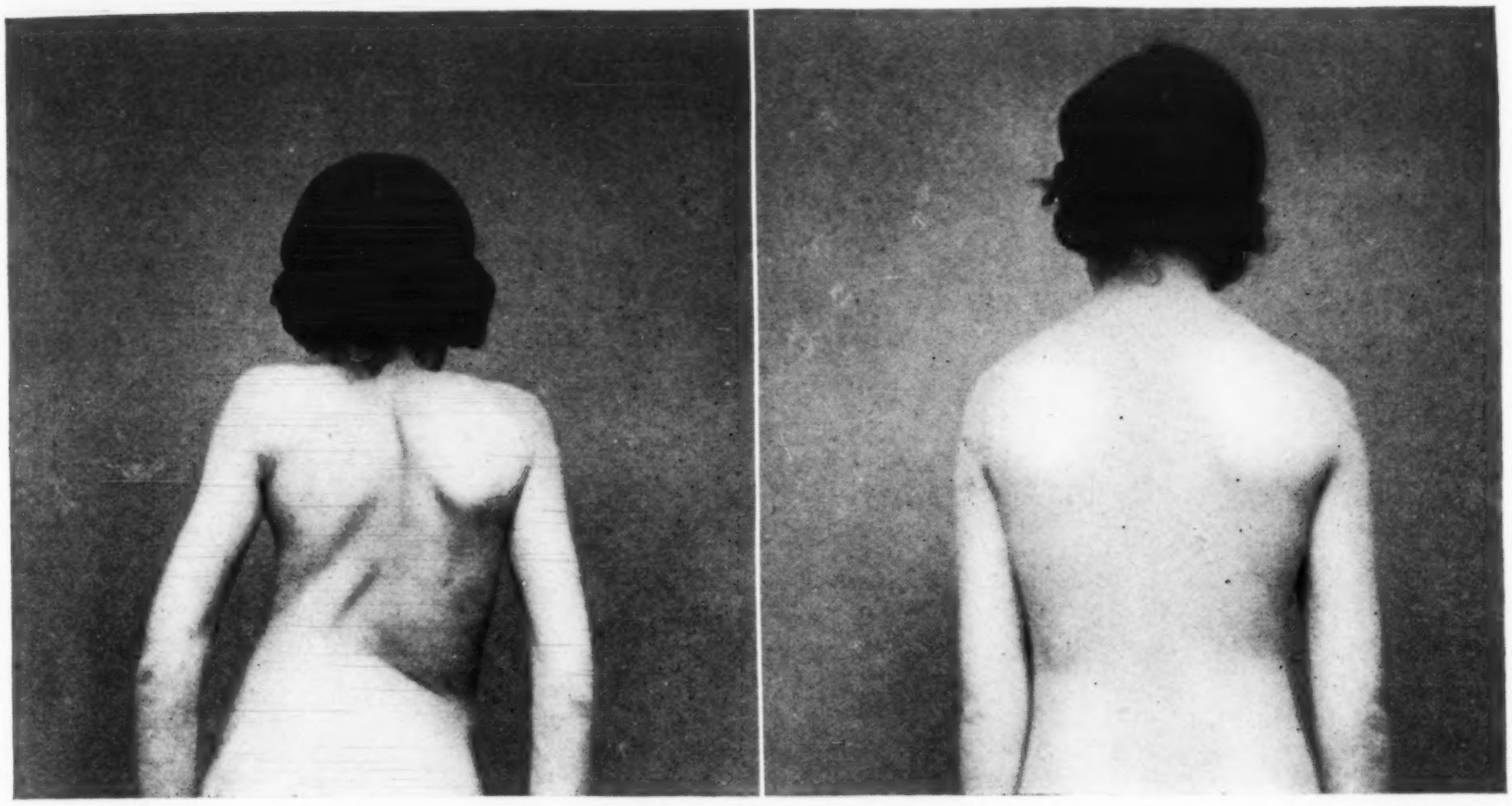
5. Freckles (location of).
6. Appearance of blood in the skin (teleangiectasis, cutis marmorata, acroasphyxia).
7. Follicular processes (lichen pilaris, acne).
8. Tongue (furrowed or not) and teeth.

C. Traits in which one-egg twins usually, two-egg twins only rarely show strong resemblances to each other:

9. Form of face (physiognomy).
10. Form of ear.
11. Form of hands (and of nails).
12. Body build.

This scheme can be extended as desired, through the inclusion of other traits; the method is therefore capable of unlimited development. As additions one would especially think of:

13. Mental make-up (school standing, character, talent).



**DIFFERENCES IN DEVELOPMENT**

**Figure 10**

At ten years of age the twins were nearly the same height (See Figure 6). Six years later one of them was about five inches taller than the other. In spite of a striking similarity of features, it seemed doubtful whether they were identical twins. An examination of a number of characters in which two-egg twins almost differ shows such marked resemblance as to leave little doubt that these are identical twins.

14. Illness and abnormalities.

15. Traits which are the bases of special methods of investigation( finger prints, microscopic comparison of the capillaries, refraction of the eyes, blood groups (and so on).

Of course, it is necessary to know the probability of agreement of these traits in one-egg twins, on the one hand; in two-egg twins, on the other hand. I have therefore, by the study of several hundred pairs of twins, reached a rough evaluation of them. In the particulars, it is needless to say that many more detailed studies are needed, such as I have for hair, eye, and skin color, goitre, acne, and so on, and such as my collaborator Decking and I have carried out for freckles.

As Mendelism has taught us the independence of individual traits in inheritance, the chance that two egg twins would be as alike as one-egg twins in *all* the particulars of my scheme is so slight that in this way, in virtually every case, one may make a diagnosis that, for practical purposes, is almost absolutely certain. How to decide in an individual, particularly doubtful case may be illustrated by an example.

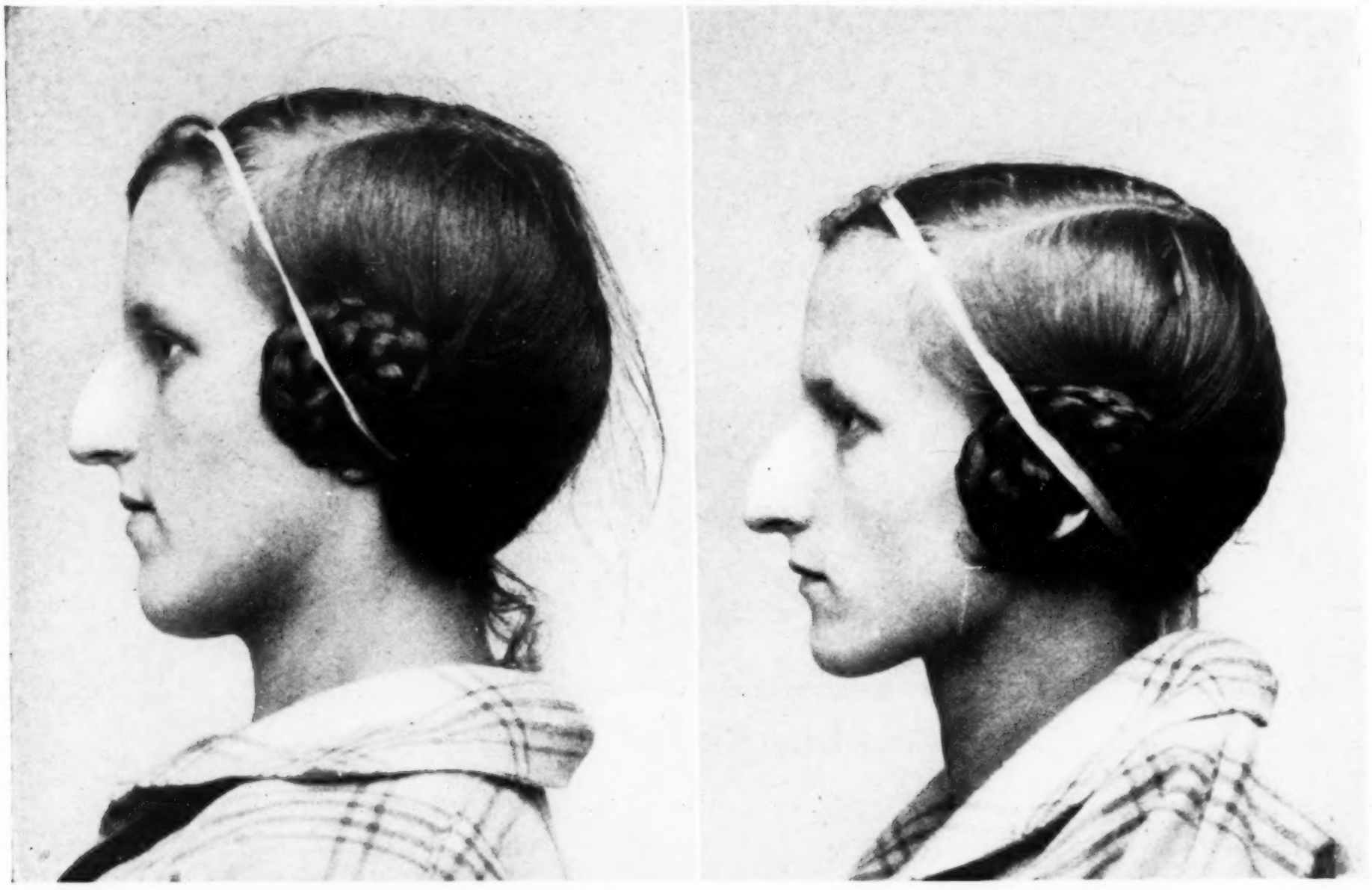
### Unlike One=Egg Twins

Sophia and Hilda M. are 16-year-old girls. Nothing is known as to the fetal membranes. Since Hilda has had a severe lateral curvature of the spine in her tenth year, the development of the two children is so different that, in spite of their similarity of countenance, people have hitherto been much disposed to doubt that they were identical. A more careful study of their resemblances gives the following result.

1. Hair color and form: no difference. Rates of change identical.

2. Eye color: green brown, no difference.

3. Skin color: in Hilda, darker where the plaster cast has pressed; face and neck browner (more out of doors!), elsewhere no difference.



THE TWINS AT SIXTEEN

**Figure 11**

Hilda is thinner than her sister, but except for this the features are remarkably alike.

4. Down hair of body: no difference that can be seen.

5. Freckles: traces in each, a little more in Hilda (more out of doors!).

6. Distribution of blood in skin: traces of telangiectasis in the cheeks of both. The one on the back of the head pronounced and equal in both. Veins on the breast are somewhat more clearly outlined in Hilda (not so well nourished!).

7. Follicular processes: Lichen pilaris moderately developed in both; equal. Acne: both have traces, alike, on the cheeks.

8. Tongue: not furrowed in either.

9. Physiognomy: Sophia's face somewhat longer* fuller because of better nutrition; in details otherwise alike to the point of confusion. (See illustrations).

10. Ear form: no differences noted.

11. Hand form: extraordinary similarity. Sophia's nails shorter, because she bites them; otherwise no difference.

12. Body build: enormous difference as the result of the severe changes in Hilda (due to rickets). Height: Sophia 154 cm., Hilda 142.

Both have a moderate goitre of equal development, both are right-handed, have equal school records. Hilda has a poorer appetite, is less energetic, but is said to be somewhat cleverer at drawing. The finger-print lines do not give any positive evidence of identity, but are nevertheless very similar (Bonnevie). The similarity of the lines of the palm is so pronounced, that the identity can not be doubted (Rominger).

We have, therefore, here a case of twin sisters, of whom one enjoys the best of health and strength, while the

*It remains to be determined how far this difference in the shape of the face is correlated with the difference in the shape of the body.

other is a permanent cripple. For this reason they have hitherto been supposed to be non-identical. But if one studies the resemblances in all details that are sufficiently well known in twins, it is found to be so complete and thoroughgoing that it could not possibly exist between ordinary sibs and, therefore, between two-egg twins.

### Rarity of Questionable Cases

It would take me too long to discuss here in detail the extent to which the traits mentioned can agree in two-egg twins. In any case it is beyond a doubt that the probability of *all* of these traits being so nearly identical in two-egg twins is so slight as to disappear from view. A mathematical calculation of this probability, such as Prof. Muller has made by his method, is superfluous here, for without any calculation it is evident that the result would be a fraction whose denominator must contain six, eight, or more ciphers.

With the aid of this method it is possible, as many years' experience in twin studies have shown me, to reach a *certain* diagnosis in virtually every case of twinning. For, when one examines their identity methodically in this way, twins as a whole fall into two well-defined groups: those with almost complete similarity, and those with numerous, quite pronounced dissimilarities. Intermediates between these two groups, whose diagnosis must remain doubtful, are in practice the same as non-existent. If one appears, however, in an exceptional case, it will at once be noticed because of its exceptionalness, and can be set apart as doubtful.

Application of the method I have used for the systematic study of resemblance justifies the conclusion that *an actual mistake in determining the identity of twins need never occur.*

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# THE FIFTH INTERNATIONAL GENETICS CONGRESS

THE Fifth International Genetics Congress, will be held in Berlin from September 11th to 18th, 1927, as announced earlier.

The organizing committee invites all persons interested in the advancement of Genetics to take part in the Congress. Persons who desire to take part in the Congress are requested to make application at the following address: V. Internationaler Kongress für Vererbungswissenschaft, Berlin-Dahlem, Albrecht-Thaerweg 6, Germany. The initiation fee of 15 Reichsmarks may be paid at the Office of the Congress upon arrival in Berlin. This fee entitles one to take part in all meetings and arrangements of the Congress*. The receipt for the amount paid will serve as a ticket of admission to all meetings. Members are requested, therefore, to guard this receipt carefully.

The subscription price for a copy of the Proceedings of the Congress is 30 Reichsmarks. This must be paid at the Office of the Congress not later than September 17th. After this date the Proceedings will be sold only at a considerably higher price.

According to the established custom, English, French and German are proposed as official languages. Action taken in the initial meeting of the Congress, may decide upon the admittance of other languages.

It is necessary to notify the program committee not later than August 1 of papers to be read before the Congress. Papers which are announced later than August 1 can only be admitted in case time is available. It will be necessary to limit the delivery of each paper to twenty or twenty-five minutes at the most.

All those presenting papers or delivering addresses are kindly requested to submit their manuscripts to the Secretary (Dr. H. Nachtsheim, Institut für Vererbungsforschung, Schorlemerallee, Berlin-Dahlem, Germany), before the opening of the Congress in order that they may be published in the Proceedings of the Congress. The ultimate date for the receipt of manuscripts is September 17th. To facilitate announcements to the press it is desired that each lecturer prepare separately a short abstract of his paper and hand it to the Secretary of the Congress before or at the opening of the Congress. Those who wish to exhibit microscopical or other demonstrations are asked to communicate with the committee well in advance and to make arrangements with Dr. Paula Hertwig (Berlin-Dahlem, Institut für Vererbungsforschung, Schorlemerallee) upon the opening of the Congress.

The Office of the Congress will be located at the University except on the evening of September 11 when it will be moved temporarily to the "Zoologischer Garten" (Kaisersaal). This Office will be opened from September 7 on.

Each person participating in the Congress is kindly requested in his own interest to register at the Office of the Congress immediately upon arrival.

At the Office of the Congress each person attending the meetings will receive a badge and a guide-book.

A special postoffice will be opened for the convenience of the members of the Congress from September 7 on. Mail addressed to members of the Congress will be obtained there. This mail must be addressed to: . . . "Postamt des V. Internationalen Kongresses für Vererbungswissenschaft, Berlin."

Foreign members of the Congress are adviced to communicate at an early date with some office of the Mitteleuropäisches Reisebureau or of the American Express Company about transportation and hotel-rooms!

The meetings of the Congress will be

*Ladies accompanying members of Congress have to pay no extra fee.

held at the University except for the opening session, which will be held in another place. This place will be announced in the definite program.

The following scientists are proposed as members of the presiding committee:

R. BLANCO-Lerida; L. BLARINGHEM-Paris; K. BONNEVIE-Oslo; C. B. DAVENPORT-Cold Spring Harbor; P. ENRIQUES-Padova; A. ERNST-Zürich; V. GREGOIRE-Louvain; R. V. HERTWIG-Munich; S. IKENO-Tokyo; W. JOHANNSEN-Kobenhavn; S. G. NAWASCHIN-Moscow; J. NILSSON-EHLE-Svalöf; R. C. PUNNETT-Cambridge; E. TSCHERMNK-SEYSENEGG-Vienna; H. DE VRIES-Hilversum; E. B. WILSON-New York.

As the number of papers already registered is high (70 papers not including the addresses) three separate sections will be formed: 1. General Genetics and Cytology. 2. Heredity in man and Eugenics. 3. Applied Genetics (Animal and Plant Breeding). These sections will be further divided if necessary.

## PROGRAM

*Sunday* 11th, from 7 p. m. on: "Begrüssungsabend" at the Restaurant Zoologischer Garten (Kaisersaal).

*Monday* 12th, Morning 10 a. m.: Opening Session (address of Welcome, Election of the Presiding Committee). Address: Professor R. V. Wettstein-Vienna.
Afternoon: Special meetings.

*Tuesday* 13th, Morning: General meeting. Address: Professor Pearl-Baltimore.—Address: Professor Rosenberg-Stockholm.—Address: Professor Federley-Helsingfors.
Afternoon: Special meetings.

*Wednesday* 14th, Morning: General meeting. Address: Professor Vavilov-Leningrad. Address: Professor Pézard-Paris.
Special Papers.
Afternoon: Special meetings.

*Thursday* 15th, Morning: General meeting. Address: Professor Correns-Dahlem.—Address: Professor Seiler-Munich.
Afternoon: Inspection of Institutes.

*Friday* 16th, Morning: General meeting. Address: Professor Crew - Edinburgh.—Address: Professor Muller-Austin.
Special papers.
Afternoon: Excursion to Potsdam and Sanssouci.

*Saturday* 17th, Morning: Business meeting (Determination of the next Meeting-place and election of the Committee for the preparation of the next Congress).
Special papers.
Afternoon: Inspection of Institutes.
Evening: Closing dinner at the Restaurant "Zoologischer Garten" (Marmorsaal).

Arrangements have been made for receptions by the government. A production of the opera has also been planned (evening-dress).

Larger excursions are planned for the closing of the Congress.

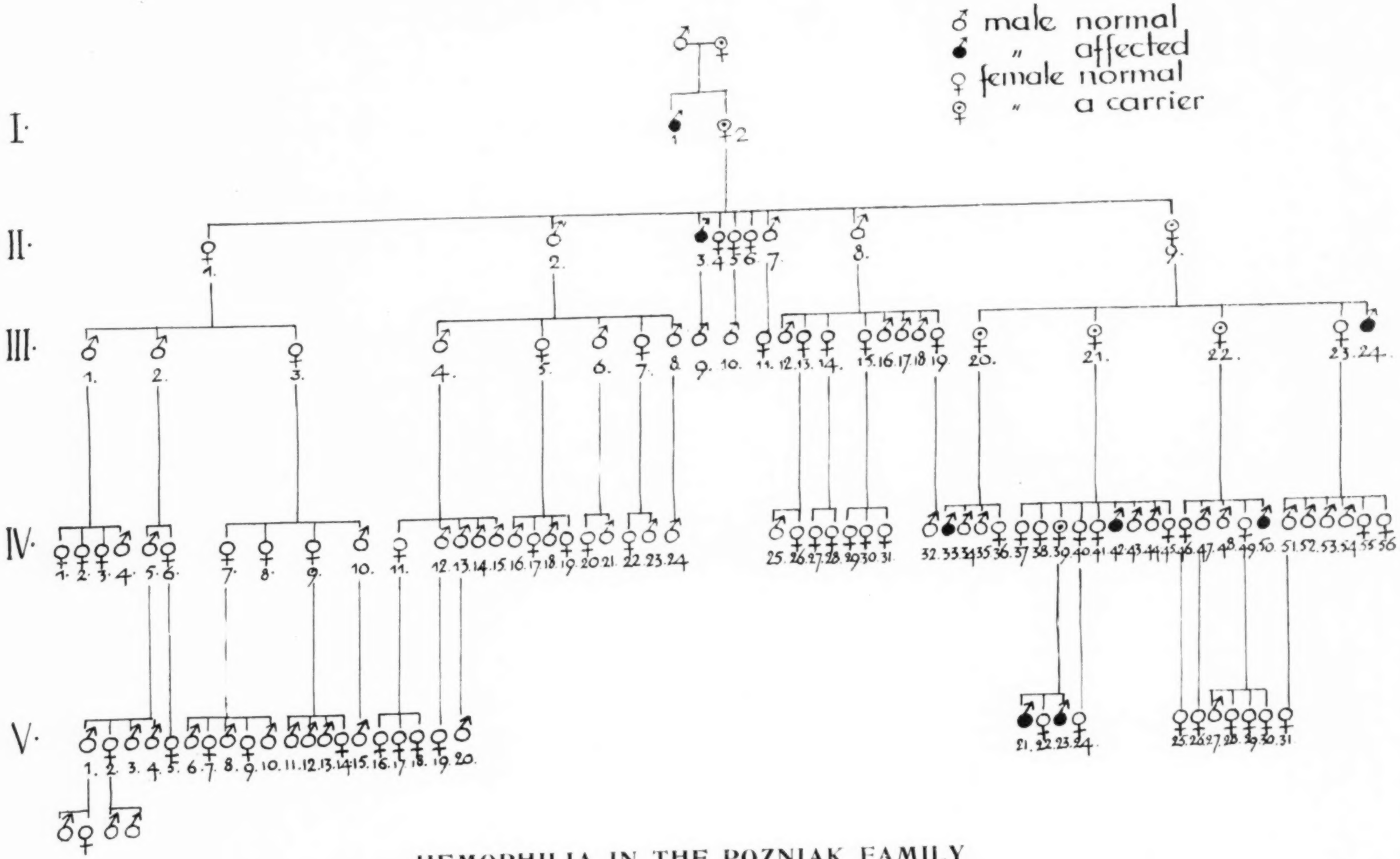
Ladies accompanying members of the Congress, not desiring to attend all scientific meetings, will have opportunity to make smaller excursions and inspections under the guidance of Berlin ladies. Special information concerning this matter may be obtained at the Office of the Congress.

All special information about the program, especially about its non-scientific part, will be published in the definite program which will be mailed to all members early in August. Besides it will be available at the Office of the Congress on and after September 7.

*Fifth International Genetics Congress, sub-committee for the preparation:*

E. BAUR,
K. BELAR,
C. CORRENS,
L. DIEHLS,
R. GOLDSCHMIDT,
M. HARTMANN,
H. KNIEP,
H. NACHTSHEIM.

# INHERITANCE OF HEMOPHILIA IN FIVE GENERATIONS.




HEMOPHILIA IN THE POZNIAK FAMILY

Figure 12

# FIVE GENERATIONS OF HEMOPHILIA

## A Supplement to the Knowledge of Hereditary Tendency to Bleeding

LOUIS LUKOWSKI,
*Pediatric Hospital, University, Wilno, Poland*

THIS paper describes eight cases of hemophilia, in which it was possible to find the hereditary relations during five generations, covering a period of 132 years (1791-1922). It occurs in a wealthy and very intelligent family, where the tradition of inheritance of hemophilia through the daughters as "carriers" has been recognized for more than 30 years—the mothers instruct the prospective husbands of their daughters about the hereditary condition (diathesis). The facts which I present were collected from many persons of generations III and IV, among them many mothers who lost their sons through this terrible disease, and they deserve complete confidence.*

*Generation* V: Two hemophilics, one of which I had under observation from the first days of life.

Patient V-23, was born in 1922. At birth he showed signs of suffocation, and in order to animate him, the midwife slapped him lightly on the buttocks, where the next day appeared large bluish marks, lasting nearly a week. Even though he was carefully preserved from any kind of injuries, he had blue marks constantly on different parts of the body. At the age of four he hit his chin on the edge of a chair, and the resulting hemorrhage of the superficial wound could not be stopped in spite of different remedies (coagulen, Roentgen, injections of the mother's blood, etc.), and the bleeding stopped spontaneously only after 48 hours. At the age of two years, at a time of freedom from bleedings, the number of plateletts was 230,000, the congulation time measured, by the Bürker apparatus at 25° C, 10½ minutes. (In the mother 5 minutes—normal)†.

In the older brother of the patient, V-21, a small cut on a finger produced a hemorrhage lasting 10 hours; a small wound on the ligament of the tongue, made by a toy of bone, bled three days; as result of a fall, he had bleeding into the knee chamber; biting through the upper lip led to hemorrhage with interruptions for five days. At the age of four he bumped his nose against the edge of a table, which was followed by severe nosebleed, and after 40 hours, by death.

*Generation* IV: Three bleeders: the full brother of the mother of the previously-mentioned bleeders and two cousins of the mother.

IV-33 often had subcutaneous bleedings for the slightest reason. On one occasion traveling 100 klm. in a soft cushioned carriage produced large discolorations in the gluteal region and on the right flank, which had touched the carriage; these bluish marks lasted several weeks. At the age of twelve he had hematomas on the right shinbone, which became infected and were operated on by a physician; the resulting hemorrhage lasted three days and resulted in his death.

IV-42. The cousin of IV-33 and full brother of the mother of the two bleeders of generation V, often had in his infancy bluish marks on his hands

*I have already written extensively in the Polish language (*Literary Review of the Physician Society in Wilno*, 1925, *Polish*: *Pamietnik Wilenskiego Towarzystwa Lekarskiego*, 1925), about this family, whom I shall call Pozniak, from the name of the top of the family tree.

†After sending this paper, on December 21, 1926, this patient suffered a slight laceration of the mucosa of the rectum. The ensuing hemorrhage did not respond to any attempted medication, lasted 44 hours and terminated in death.

from hitting the table, and once even the skin of the child showed a whole row of little bluish marks, corresponding to the buttons on the blouse of the nurse-maid, who carried him in her arms. He died at age of ten months from influenza.

IV-50 had almost permanent bluish marks after the slightest fall. In the second year of age, after a fall, bleeding from the lip, that lasted two days and was stopped only by cautery. He died at the age of two years after two days of fever exhibiting an extreme pallor of skin (internal hemorrhage?), without an established diagnosis.

*Generation* III: Only one bleeder, III-24, had dangerous hemorrhage twice: in the second year of life he lacerated his throat with a bit of wood, with the result of a hemorrhage of many days' duration. In his fourth year he bit himself on the lip and caused bleeding lasting with interruptions, six weeks, which was stopped only after cautery with hot iron. After the dead layers fell off, the bleeding began again, and again cautery was necessary. He often had hemorrhages in the joints. At twenty years of age he accidentally severed a small artery in the thigh, with a knife, and in spite of immediate help of a surgeon (ligature of the artery), died after 36 hours of hemorrhage.

*Generation* II: Also only one bleeder, II-3. After the slightest injuries often had hematomas and bluish marks. As a man of thirty he lifted a heavy object and got an internal hemorrhage from which he died. He had one son, III-9, who died in the third year of life from an unknown disease, but who did not exhibit any symptoms of hemophilia.

*Generation* I: One hemophilic, the brother of the mother of the whole family tree, I-1. There are no details of his life; it is only known, that sitting in a cab, held by his nurse, the horse jerked the cab, causing the child to bite his tongue. He died after many days of bleeding, in the year 1791.

As it can be seen from the chart, in this family there were eight male bleeders in five generations, and not one woman hemophilic. Many women among them developed bluish marks easily, none of them not only did not die of hemorrhage, but the tradition preserved does not relate any serious cases of bleeding. On the contrary the illness was inherited only through the women: sisters of manifest bleeders. The husbands of the women of this lineage did not have hemophilia and, therefore, are not mentioned.

In this family the ancient empirical principle discovered by Nasse in 1820 is confirmed, that hemophilia can be inherited only through women, but the men only suffer from it. The facts collected by me are thus not in agreement with those published by Bess Lloyd in the JOURNAL OF HEREDITY for January, 1925.

Numerically the following observations can be made from the family of Pozniak. In addition to the eight above-mentioned hemophilics, I counted in the same family nine healthy men (II-2, 7 and 8; IV-34, 35, 43, 44, 47 and 48). The proportion of the "carriers" of the bleeders to their sisters, who had only healthy sons, is 6 to 4. ((I-2; II-9; III-20, 21 and 22, and IV-39 to II-1 and 5; III-23 and IV-49). The small number of these last women can easily be explained by the fact, that a part of women of this family, burdened with such an inheritance, had no children, or sons, at all and, therefore, had not the occasion to demonstrate their own taint.

The numerical data of this paper are not in contradiction with the Mendelian theory.

It is interesting to note the result of an investigation of the progeny of the woman II-1, the sister of the bleeder. During five generations there was not one occurence of hemophilia.

# NIGHT BLINDNESS IN CATTLE

W. A. Craft
*Oklahoma A. and M. College*

IN February, 1926, the Gabriel Brothers, of Alma, Oklahoma, called the writer's attention to a peculiar eye defect in some of the young cattle in their herd of Milking Shorthorns, which they called "moon-eye". The behavior of the affected animals suggested that they were blind at night, while in sunlight they appeared to have normal vision. The owners stated that the eyes of these affected animals seemed to be normal.

The writer inspected this herd on June 25 (1926) and obtained the following history of the cases:

"Night-blindness was noticeable during the first week after calves were dropped, because they were hand-fed from a pail. The calves could not see a pail, but would move about bumping into the wall and into the fence around the calf pens. When they were driven from one yard to another it was difficult to get them through gates at night. It was also noticeable that after dark they would move about like a blind horse, stepping high and stumbling over anything that came in their way. They appeared to get around in bright moonlight with less difficulty but did not move with the same ease as they did during the day. The first two calves (one male and one female from different sires) from one cow showed this peculiar defect. Both the sires and the dam had perfect vision, however. Another calf dropped in November, 1925, proved to have this defect. The dam of this last calf had produced four calves with normal vision, and one of them was sired by the same bull that sired this 'moon-eye'."

The writer was fortunate enough to see this last-mentioned calf at the farm (the others had been marketed), and it was carefully examined. No visible defect could be seen in the structures of the eye, but it was observed that the behavior of this calf had been described correctly. The calf was about eight months old at this time and still seemed to be blind at night.

In discussing the structure of the eye Smith* gives the following facts:

> It is in the rods and cones that the primary conversion of light vibration into visual impulses takes place. The rods contain a pigment known as visual purple or Rhodospin, which is readily decomposed by light, especially by the blue and violet rays, by which the pigment is decolourized. The colour is regained in a dim light. The perception of colours . . . . is not due to the rods. The cones are regarded as the visual cells in bright light, and provide acute vision; the rods are adapted for dim light, as is proved by their decolourization by a bright light, and the fact that they are numerous in animals which seek their food by night. It is the tapetum and the rods which enable feline animals to prey by night, and the same structures enable the herbivora to find their way and move freely in what to us is darkness. . . . . There is no tapetum, or rather none exposed in the peripheral zone, it being covered by the dense pigment of the retina; it is obvious that reflection cannot occur here. We may therefore assume that night vision in animals is central, and not peripheral.

## Affected Calves Related

Examination of the pedigrees of the affected calves show that they were related. Each of the pedigrees showed linebreeding to a common ancestor, SC, from whom it seems likely that the defect was inherited. The sires of the calves were not seen by the writer, but the dams were observed and no visible defects of the eyes were evident. The owners stated that none of the breeding stock had been found to have this defect.

Examination of the eye with the aid

*Smith, F. A Manual of Vet. Physiol. 5th ed., 584, 1921.

of an oil lantern revealed that the structures involved in accommodation were at least attempting to function. However, it can not be said that accommodation was complete, because it could not be determined whether the pupil was sufficiently dilated for night vision, but closure of the pupil and contraction of the ciliary muscle was evident when light was placed before the eye.

It is suggested that night blindness in these cases may have been due to an hereditary defect involving the arrangement of the rods and cones of the retina. However, the data at hand are only suggestive, but it is hoped that further observations may be made.

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## "Abaca" and "Manila Hemp"

Editor, THE JOURNAL OF HEREDITY:—

It seems unfortunate that the term "Manila Hemp" was used in the article entitled "Introduction of Manila Hemp," by Mr. P. J. Wester, in the March number of the JOURNAL OF HEREDITY. The author must certainly have been familiar with the use of the term "abacá" in nearly all recent publications referring to this plant, and also with efforts that are being made to restrict the use of the name hemp to its true and original meaning to designate the plant, *Cannabis sativa,* and its fiber, and thus avoid confusion.

These seeds were not "the first abacá seed to be successfully germinated in the United States." More than 100 seedlings were grown in the greenhouse of the U. S. Department of Agriculture at Washington from seeds (S. P. I. 9028) in 1902. These seeds were collected by Mr. John W. Gilmore then in the Philippine Bureau of Agriculture, and they were packed in charcoal in a tin mailing tube. Numerous other shipments of abacá seed packed in this manner have failed. Some of these early seedlings were sent in 1903 to the Experiment Station at Mayaguez, Porto Rico, where they were planted by Mr. O. W. Barrett. These plants, propagating by suckers, have continued where they were originally planted 24 years ago, and so far as known constitute the first successful introduction of abacá into America.

In March, 1911, seed of the Maguindanao variety of abacá, packed in charcoal in a tin mailing tube was received from the Philippine Bureau of Agriculture, (S. P. I. 30683). These were planted in the greenhouse of the U. S. Department of Agriculture and early in May there were about 1,200 seedlings 2 to 4 cm. high. More than 900 of these plants were distributed to seven different localities in the West Indies, Central America and Hawaii. Some of them are still surviving, but most of the plants are inferior to the parent type.

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## Anthropologia Suecica

THE RACIAL CHARACTERS OF THE SWEDISH.. NATION, *edited by* H. LUNDBORG and F. J. LINDER. Upsala, 1926.

The oldest nation in Europe, with a continuous history reaching back beyond the commencement of the Christian era, Sweden is also the particular domain of the Nordics, only one-tenth of its inhabitants being broadheaded. The present study, embodied in a huge and magnificent volume, by the Swedish State Institute for Race Biology, deals primarily with the statistics of 47,387 conscripts; but it is illuminated with special studies and papers on the history and geography of Sweden, the anthropology of Europe, and so on. In every way the book is a fitting monument to Swedish science and the Swedish nation.

*P. P.*

# A SIMPLE MEASURE OF FECUNDITY

## Based on Census Figures

ROLAND M. HARPER

SOME years ago Dr. Walter F. Willcox proposed as a measure of fecundity, for times when or places where there were no birth statistics, the ratio between children under five years old and women between the ages of 15 and 45.* This is an excellent method, and it has been used by several subsequent investigators, sometimes with the modification of counting only married women instead of all women between the ages named.† But it has one serious limitation. Since the Civil War the data required have been published only for states and larger cities, so that it is impossible to show by this means the great variations in the rural portions of some states.‡

A simpler measure, applicable to every city and county in 1920, and to every state for many decades back, and at the same time to different races, is the ratio between minor children and adult women. In some of the older censuses the ages are divided at 20 instead of 21, but the number of persons between 20 and 21 can be estimated pretty closely. Data for single counties for censuses previous to 1920 can also be approximated fairly well from the published figures.

Although this method takes no account of whether the women are young or old, single, married, widowed or divorced, the number of mothers under 21 partly balances the number of unmarried women above that age, for 21 is close to the average age of marriage of women in the United States, as can be easily ascertained from the statistics of marital condition which have been published for every United States census since 1890. If the numbers of men and women were equal, the ratio of children to women would be just double that of children to adults, which is likewise easily ascertained. But, as is well known, the sex ratio varies from a considerable excess of women in countries which have recently been at war, and a moderate excess in some of our cities and older states, to a great excess of men in the mining and lumbering and stock-raising regions of the West; and this profoundly affects the average age of marriage for either sex.

### Sources of Error

In using the ratio here suggested there are two or three possible sources of error to be borne in mind. First, women, especially those of marriageable age, have long been prone to understate their age.§ This is easily seen in any census table that gives ages of males and females by single years, for according to the published figures

*Quart. Pub. Am. Statist. Assce. Vol. 12: 490-499. 1911. For applications of this method see pages 283-297 of the U. S. Census volume on Negro population, 1918, and pages 37-39 of "Population Problems," edited by Louis I. Dublin. 1926.

†All women would seem to be more significant than married women, for in a community where half the women never married, and the rest averaged 5 children apiece, the net result would be the same as if all married and averaged 2½ children apiece.

‡The 1920 census gives for every county, and for cities of over 10,000 inhabitants, the number of children under 7 and of men and women between 18 and 45, but without separating the races.

§This tendency was noticed and commented on by Professor George Tucker before the middle of the last century. (See Compendium of the 7th U. S. Census, p. 56.) It seems to be much the same all over the United States, and among different races, and evidences of it have been noticed by the writer in the latest censuses of Cuba and Brazil. It seems likely

nearly every state has more girls than boys between the ages of 15 and 20 and especially between 20 and 21, while between 21 and 22 the proportions are just about reversed, for some of the young men falsify their ages in the opposite direction, for obvious reasons. This makes the apparent ratio of children to women a little larger than it really is, but as the percentage of error from this source seems to be about the same everywhere, it does not materially affect the value of the figures for comparing different times and places.

Another source of error, which may be serious for some counties or cities, but not for whole states, is that many communities contain educational, religious, charitable, penal, military or naval institutions, whose inmates may differ greatly from the average of the community in age, sex, and marital condition. And the U. S. Census Bureau has nearly always counted those in with the regular population, instead of making a separate category for them, as could easily be done, and should be at future censuses.*

Places that have had a large recent immigration of adults, like some of the "boom" cities of Florida and California, of course have an abnormal age distribution of population, but one simply has to make allowance for that as best he can, or wait until the influx shrinks to normal proportions. However, if the migrants are mostly men, as in the case of the northward migration of negroes in recent years, this may not seriously affect the ratio of children to women.

Typographical and clerical errors also occur occasionally in census reports, probably more in the earlier than in the later ones, but they are rare, and if serious are easily detected.

The ordinary birth statistics are subject to the same possibilities of error already mentioned, and a few others besides. First, incompleteness of the returns; for any birth that fails to be recorded reduces the apparent birth-rate just so much. But in a census, incompleteness is not such a serious matter, for even if half the population were overlooked the remainder might give a very typical sample of race, sex, age, etc. Second, birth rates calculated for periods several years after the latest census may be inaccurate on account of unknown changes in the total number of inhabitants. Third, many births (as well as marriages and deaths) of nonresidents occur in our cities, and it is not always possible to credit them to the community to which they properly belong. (But this might not affect the rates for a whole state perceptibly.) Fourth, the number of births fluctuates from year to year (and deaths probably still more so), so that several years should be averaged to get reasonably accurate results. The ratio here used is au-

that in this country about half the ladies tell the truth about their ages and the rest subtract a few years, making the average discrepancy at the prime of life about two years. The writer when working on the Florida state census in 1925 noticed a few cases where the ages of women had been underestimated ten or twenty years; but the ages of men were not always given correctly either, perhaps because some wives when interviewed by the census takers did not want their husbands to appear too much older than themselves. (See note on page 223.)

*My attention was first called to this a few years ago when studying the statistics of certain towns in Iowa. One of them, Glenwood, showed up with about 25% of the adults illiterate, and there was no hint in the census report of any reason for that. One might have been inclined to ascribe it to a typographical error; but subsequent investigation brought out the fact that the state asylum for feeble-minded was located there! Dannemora, N. Y., has an abnormal excess of adult males, on account of the presence of two penal institutions there, and a similar abnormality exists in Chattahoochee County, Georgia, on account of the establishment of an army camp (Fort Benning) there during the World War, and its subsequent maintenance, and in Leavenworth County, Kansas, which contains a training camp and two federal prisons. In the Florida census of 1925 the inmates of institutions were counted separately, for otherwise one county would have had about 10% of its inhabitants classed as lunatics, and another a similar proportion of felons.

tomatically smoothed for a 21-year period, so that a complete cessation of births for one year would change it only about 5%.

### Native and Foreign Stocks

In the birth statistics which have been published annually since 1915 by the U. S. Census Bureau the mothers are classified not only by race but by nativity; and in practically every state in the "registration area" foreign-born women are thus shown to be more prolific than native ones, and there are considerable variations among different nationalities; which confirms what had long been known in a general way or in a few states that had been keeping such records. It seems to be well established that recently arrived foreigners, of almost any nationality, are more prolific than families that have been in this country a generation or more.

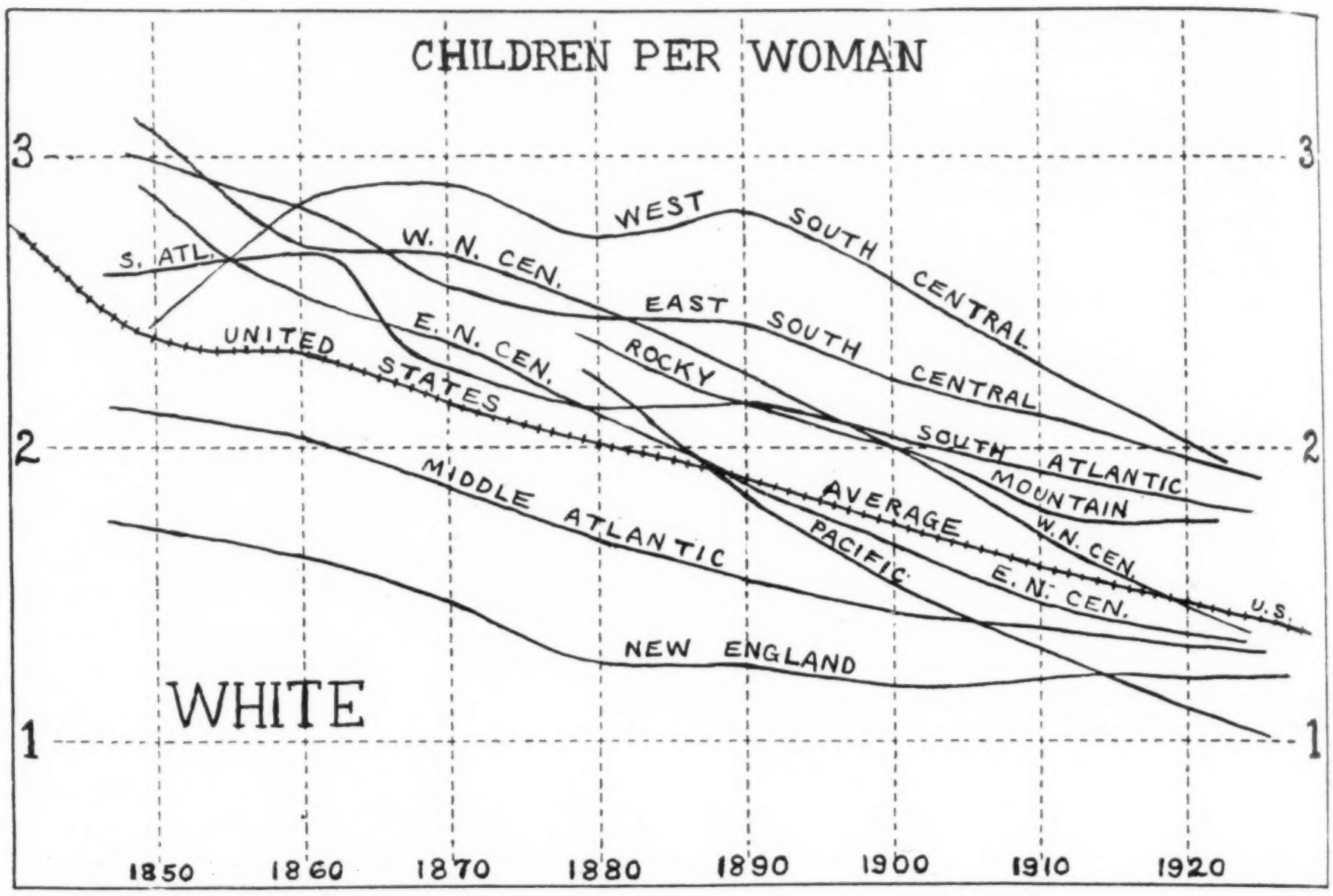
One might suppose at first thought that the children-per-woman ratio here used would be useless in comparing native and foreign stocks, for many foreign-born women of course have all or most of their children born in the United States. But it is possible to make estimates of this sort, probably correct within 5%, for each state and larger city in 1920. For earlier censuses, and for counties and smaller cities, the published figures are less detailed, but one can make rough estimates which may be better than none at all. The calculation requires considerable adding and subtracting, and it will not be necessary to go into all the details here. It will probably suffice to say that one-third of all the minor children of mixed parentage are regarded as having foreign mothers, and two-thirds native mothers (which was about the ratio in 1880). Then when the foreign-born children, the natives with both parents foreign, and those of native parentage, are properly distributed the calculation is made in the usual way. Of course, there are a few persons in this country who were born abroad of American parents, and there may be a few foreign-born youths in their teens whose mothers are still in the old country, or no longer living, and a few foreigners returned as natives, but such cases are probably so few as to be negligible, and in any event the errors resulting from them balance each other to some extent.

There does not seem to be any way of comparing different nationalities in this country by this method, except indirectly by comparing communities in which one or another nationality is known to be very largely represented. But the differences which it gives between all native and all foreign women in the same state are entirely consistent with the birth statistics of the registration states, and they also show some interesting contrasts in several states which are not yet in the registration area.

In 1900, which seems to be as far back as we can carry this method for natives and foreigners with any degree of confidence, native white women averaged about 1.6 minor children and foreign whites about 2.3. In twenty years these ratios decreased to about 1.4 and 1.8, as shown in the table farther on.

For 1920 we can also easily ascertain the children-per-woman ratio in the rural and urban population of any state or county, and find some significant differences. For 1910 we can estimate the rural and urban ratios pretty closely, but there do not seem to be any such data for earlier censuses.

One advantage of the children-per-woman ratio, over other statistical measures, is that in many cases it closely approximates the ratio between births and deaths. This may be explained as follows. The number of children per family at the time of the census (or at any other time) is of course less than the number ultimately born to the average couple, for there are always many young




**THE DECLINING CHILDREN-PER-WOMAN RATIO**

**Figure 13**

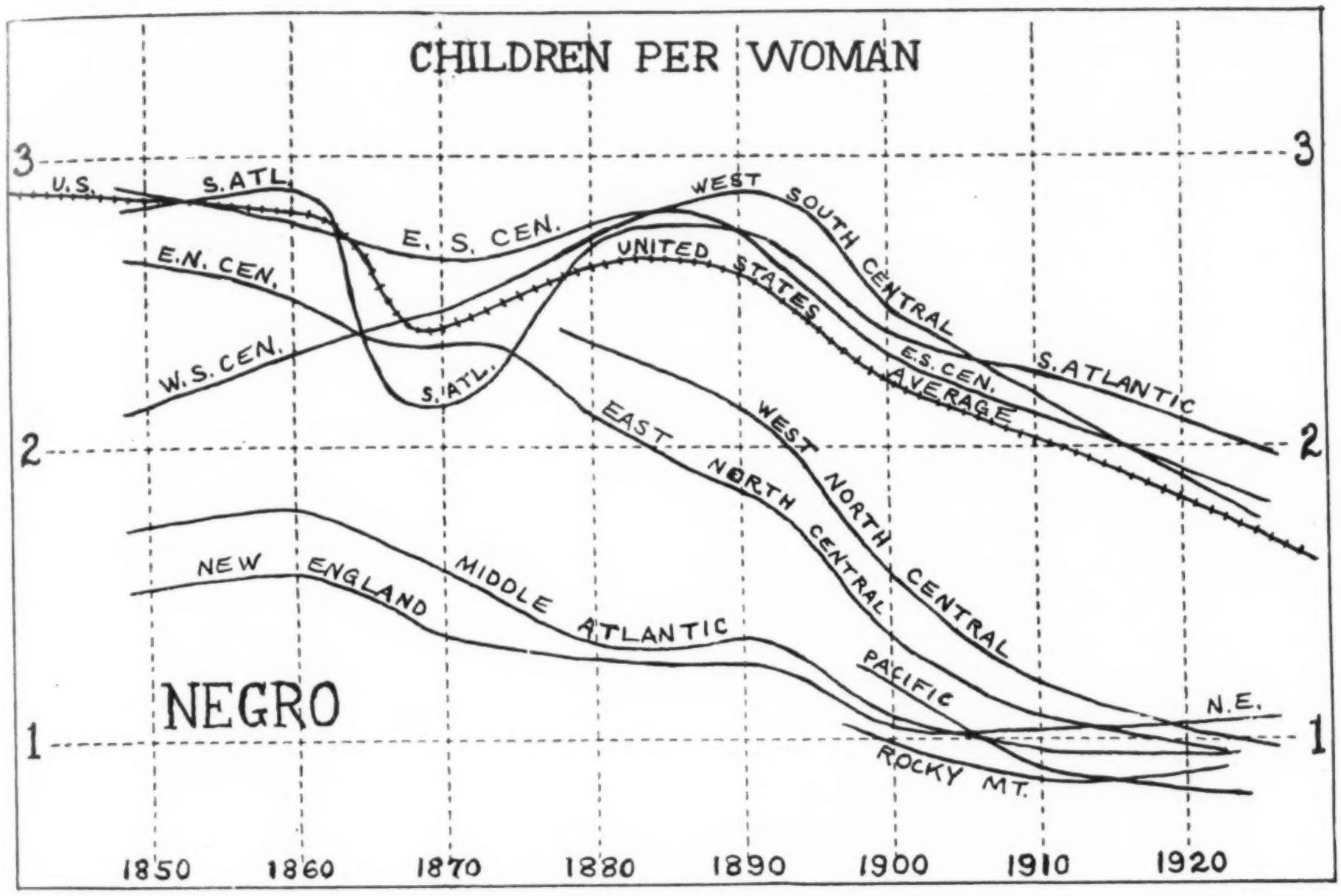
Graph showing ratio of children to women in the white population of the United States and its nine major divisions or sections, from 1850 to 1920. The curves for the Rocky Mountain and Pacific Coast sections are carried back only to 1880, because the population previous to that was too small for accurate ratios.

couples whose children are all in the future, and old couples whose children are already grown (if not dead). If the ratio of present to ultimate children were exactly half, and the number of men and women were equal (and these conditions are pretty nearly realized in many places, especially among the Southern negro population), one child per woman now would mean two per couple ultimately, or just enough to maintain the population, making births and deaths equal.

Another evidence of the reasonableness of this assumption is found in the fact that one child per woman seems to be a minimum that no normal community ever falls much short of. Although we do have many communities with a smaller ratio than that, they are nearly all cities that have had recent large accessions to the adult population; and if the influx ever ceased the ratio might soon rise above 1.

### Changes Since 1850

The changes in the ratio of children to women in different parts of the country during the last three-quarters of a century are shown by two graphs, one for whites and one for negroes, covering the period from 1850 to 1920. Each graph has one curve for the whole United States and one for each of the nine sections into which the country is often divided by the Census Bureau for generalized statistics; but some of the curves are not carried all the way back to 1850 because the western states were too sparsely settled then. Curves for both races could not have been put on the same graph without confusion, and for the same reason




**RATIO IN THE NEGRO POPULATION**

**Figure 14**

Graph showing ratio of children to women in the negro population of the United States and its nine major divisions or sections, from 1850 to 1920. The curves for some of the western sections are not carried all the way back to 1850, because there were too few negroes in those parts of the country in the early days for accurate ratios. As most of the negroes are in the South, the U. S. average curve is close to those for the three southern sections.

those for single states, native and foreign whites, and urban and rural population, are also omitted. (Figures for these last are given in the table farther on.)

The most striking feature of both graphs is the progressive descent of all the curves, corresponding to the well-known decline of the birth-rate. From rather fragmentary data one may infer that the number of children per woman in this country was about four in the middle of the 18th century, and three in 1820, whereas by 1920 the United States average had come down to 1.52. The three southern divisions have long been the most prolific, while New England is at the other extreme, or has been until recently. The North Central states had a fairly high birth-rate in their pioneer days, but the eastern group of them seems to have dropped below the national average in the late 80's, and the western group only a few years ago.

Looking particularly at the negro graph, we see that on the basis of fecundity our negro population can be divided rather definitely into two groups: those in the South and those in the rest of the country. And the regular birth statistics, which have been available for some time for many northern states, and are gradually being extended to the South, show the same tendencies. Up to the 70's the North Central negroes were about as prolific as those in the South, but now they are much like those of other northern states in that respect. The explanation of this is doubtless that

formerly most of the negroes in the states classed as North Central were close to the southern border of that section, especially in Missouri, which is sometimes classed as a southern state; but now that the members of that race have spread over a wider area in the upper Mississippi valley they seem to have taken on more of the northern characteristics there.

If the ratio of children to women in the whole United States continues to decline at the same rate that it has in the last fifty years it will reach the assumed minimum of 1 soon after the middle of the present century; and most of the sectional curves seem to be headed for the same point about the same time. (The ratios for negroes in the northern and western sections are already near or below 1, and there are usually about as many deaths as births among the negroes in those parts of the country.) But the rate of decline will probably diminish as the minimum is approached, just as a heated object cools more slowly as its temperature approaches that of its surroundings.

## The 1920 Census

The following table gives some details for 1920, including the ratio of children to women in the white and negro and rural and urban population of each section of the country simultaneously, and also for native and foreign whites and negroes in the whole United States in 1900, 1910 and 1920.

This table shows among other things that in the matter of fecundity the South exhibits much more difference between city and country but less difference between whites and negroes than the North and West; that the urban ratios do not vary as much from one section of the country to another as the rural ones do; and that negroes are not very prolific in cities, even in the South.*

It is a curious fact that communities which have a high white birth-rate generally also have a high negro birth-rate, and vice versa, unless the disparity in numbers of the two races is too great. This applies not only to state averages—which one might imagine to be influenced by climate—but also to counties and cities; as if the negroes imitated their white neighbors in that respect, consciously or unconsciously. It is not altogether a matter of standards of living, for in regions in the South where negroes are greatly in the majority one usually finds a much greater contrast between the races in per capita wealth, etc., than where negroes are in the minority and thus have plenty of white neighbors to set examples for them.

Some additional figures for times and places not represented in the graphs and table may be given here.

**TABLE I—Ratio of Children to Women in the Aggregate, Rural and Urban Population of the United States, 1900 to 1920, and in the Nine Major Divisions in 1920, by Race, etc.**

| | Aggregate | | Rural | | Urban | |
|---|---|---|---|---|---|---|
| | White | Negro | White | Negro | White | Negro |
| Whole United States, 1900 | 1.78 | | — | — | — | — |
| Whites | 1.74 | — | — | — | — | — |
| Native | 1.58 | — | — | — | — | — |
| Foreign | 2.26 | — | — | — | — | — |
| Negroes | — | 2.24 | — | — | — | — |
| Whole United States, 1910 | 1.64 | | 2.00 | | 1.31 | |
| Whites | 1.60 | — | 1.92 | — | 1.32 | — |
| Native | 1.53 | — | — | — | — | — |
| Foreign | 1.85 | — | — | — | — | — |
| Negroes | — | 2.03 | — | 2.59 | — | 1.14 |
| Whole United States, 1920 | 1.52 | | 1.93 | | 1.21 | |
| Whites | 1.49 | ---- | 1.87 | ---- | 1.22 | ---- |
| Native | 1.41 | ---- | 1.83 | ---- | 1.04 | ---- |
| Foreign | 1.80 | ---- | 2.12 | ---- | 1.71 | ---- |
| Negroes | ---- | 1.81 | ---- | 2.37 | ---- | 1.06 |
| New England whites, 1920 | 1.21 | ---- | 1.28 | ---- | 1.19 | ---- |
| " " negroes | ---- | 1.06 | ---- | 1.46 | ---- | 1.02 |
| Middle Atlantic whites | 1.32 | ---- | 1.52 | ---- | 1.27 | ---- |
| " " negroes | ---- | 0.95 | ---- | 1.49 | ---- | 0.89 |
| East North Central whites | 1.36 | ---- | 1.58 | ---- | 1.22 | ---- |
| " " " negroes | ---- | 0.98 | ---- | 1.57 | ---- | 0.91 |
| West North Central whites | 1.48 | ---- | 1.82 | ---- | 1.12 | ---- |
| " " " negroes | ---- | 1.03 | ---- | 1.59 | ---- | 0.89 |
| South Atlantic whites | 1.82 | ---- | 2.18 | ---- | 1.26 | ---- |
| " " negroes | ---- | 2.08 | ---- | 2.57 | ---- | 1.17 |
| East South Central whites | 1.97 | ---- | 2.23 | ---- | 1.27 | ---- |
| " " " negroes | ---- | 1.91 | ---- | 2.25 | ---- | 1.10 |
| West South Central whites | 2.03 | ---- | 2.39 | ---- | 1.38 | ---- |
| " " " negroes | ---- | 1.90 | ---- | 2.28 | ---- | 1.17 |
| Rocky Mountain whites | 1.75 | ---- | 2.08 | ---- | 1.29 | ---- |
| " " negroes | ---- | 0.88 | ---- | 1.34 | ---- | 0.74 |
| Pacific Coast whites | 1.12 | ---- | 1.54 | ---- | 0.94 | ---- |
| " " negroes | ---- | 0.84 | ---- | 1.42 | ---- | 0.78 |

*Statistics of age distribution, marital condition, illiteracy, magazine circulation, etc., also bring out some of the same differences between North and South, city and country, whites and negroes.

In 1850, in the whole United States, the number of children per woman was 2.38 for whites, 1.97 for free negroes, and 2.86 for slaves. In 1920 it was 2.31 for Indians, and about 2.08 for the farm population of all races (which constituted about 60% of the so-called rural population). The state averages in 1920 (for all races combined) ranged from 0.80 in the District of Columbia and 1.04 in California to 2.24 in North Dakota and 2.32 in South Carolina.

### Rural and Urban Ratios

Every section of the country has more children per woman in the rural than in the urban population (though the difference is not great in New England, on account of the large foreign element in the cities); but that of itself would not necessarily indicate greater fecundity in the country (or greater longevity in the city), for there has been a constant migration from country to city ever since we have had censuses, so that many people spend their childhood in the country and their adult life in the city. (The same cause makes birth and death rates more nearly equal in cities than in the rural districts, for obviously many people who are born in the country die in the city.) But after making due allowance for the effects of migration, it appears that country people are usually the most prolific anyway. Cities which are growing very slowly or not at all do not seem to differ much in the age distribution of their population from the more "progressive" ones, if other things are equal; and there is abundant evidence that people generally marry later in cities than in the country, and divorces are more frequent, and automobiles and other luxuries that partly take the place of children in the family budget, are more numerous.

EDITOR'S NOTE:—It is perhaps of historical interest that Professor George Tucker, of the University of Virginia, in his book, "Progress of the United States in Population and Wealth in Fifty Years" (Boston, 1843), used a very similar method to show the decline in fecundity in the United States between 1800 and 1820. Professor Tucker's book is now very hard to obtain, and his use of this method was not discovered until just before Professor Harper's article went to press.

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## 87-Child Family a Myth

IN the fall of 1926 an account was widely published in the newspapers of a German family totalling 87 children. The story was alleged to have appeared in an Austrian medical journal. Even the name of the family was given in some of these accounts. A man by the name of Scheinberg was said to have been married twice, by his first wife he had 69 children—four quadruplets, seven triplets and sixteen sets of twins. After the death of his first wife he married again and had 18 additional children.

The story seemed so remarkable that an inquiry as to its authenticity was addressed to authorities on eugenics and population in Germany and Austria. Absolutely no confirmation of the existence of this huge family has been obtained. Dr. Felix Tietze, of Vienna, writes:

> After having spoken to or corresponded with all the persons concerned with eugenics, growth of population, etc., I can assure you that some misunderstanding must be the basis of that rumor, the unlikelyhood of which was obvious from the first moment.
>
> One of my German correspondents accentuates, that there is no family known with only the third part of the mentioned children. He means, the news must have been induced either by a joke or by a misprint. It would be possible also that the mentioned figure does not refer to the children of one household, but to the total of the living descendents of one family.

In a later letter Dr. Tietze informs us that no record of the Scheinberg family is to be found in the *Aerztliche*

*Standeszeitung,* the journal in which the story was alleged to have appeared.

Dr. Fritz Lentz, of the University of Munch, who has investigated a number of such alleged cases finds that hysteria or a desire for publicity causes an amazing expansion of ordinary-sized families:

> Similar stories of families with repeated multiple births are often reported. Generally they turn out to be the hallucination products of hysterical women, who want to make themselves interesting through accounts of multiple births.

In the medical literature are accounts of women having nearly 50 children, but none of these is accepted as unquestionably authentic. One of the most reliable is considered to be the case of Dr. Mary Austin, a Civil War nurse. She lays claim to a family of 44 children — 13 twins and 6 triplets—and in addition she found time to study medicine and get a doctor's degree while she was bringing up her family!

It would be a matter of scientific interest to have reliable information about the maximum size of human families, and any one who knows of families approaching a third the size of the alleged Scheinberg family is invited to communicate with the Association.

ROBERT COOK.

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## A Melting Pot of Essays on Population

SOME authorities contend the population of the world is increasing at an alarmingly rapid rate, and all will agree that the rate of increase of the books on the subject is even more rapid.

In 1924 the American Statistical Association devoted its attention to population problems; all phases of population were considered including natural resources, immigration and minimum wage theories. Doctor Dublin of the Metropolitan Life Insurance Company conceived the bizarre idea of making book fellows of the heterogeneous opinions of the contributors to this program, which accounts for the parentage of this addition* to the family of books on population. It is to be regretted that contraceptive measures were not vigorously applied.

Not unnaturally, there is little agreement among the nineteen contributors, wherever their fields overlap, and the reader is assured the population is becoming too dense as well as that it is dangerously declining in numbers. Further, synthetic foods and intra atomic energy are viewed as reasonable possibilities or as ridiculous absurdities, depending upon the optimism of the contributors.

A similar situation holds for immigration restriction, some authorities contending it to be a mistake, others holding it to be a distinct gain. Nordic propaganda is generally discounted and since most of the authors have confused this journalistic bombast with eugenics, the latter is read out of court.

Human heredity, when mentioned at all, is considered as a minor matter of little importance in the growth of population.

If the reader is interested in the subject of population he will find the book disappointing. The individual essays are short and consist of little more than opinions but the book is of interest in showing how this complex subject appeals to men in academic environments.

*J. H. K.*

# THE GRADES OF RELATED STUDENTS

R. R. Huestis and T. P. Otto
*University of Oregon*

OUR past experience in genetic investigation has led us to believe that when related individuals are confronted with the same sort of environment they will react, more often than not, in much the same manner. I have, therefore, always felt safe in assuring my students in heredity that an investigation of the matter would show a correlation between the grades obtained by members of the same family at the University of Oregon. The junior author wished to subject this prediction to a pragmatic test and gathered together the grades of one hundred pairs of sibs and calculated, under my direction, the correlation coefficients presented in the following table. We are greatly indebted to the registrar, Mr. Carleton E. Spencer, for access to the records from which the raw data were obtained.

Grades were taken at random from the registrar's office for the sophomore year of 100 students who attended the university since 1919, who had a brother or sister in attendance for a sophomore year during the same time. Grades of students who attended the university prior to 1919 were not used because a different system of grading was then in vogue. A numerical index of a year's grades was obtained by allowing 5 points for a credit hour carrying the grade of I, 4 points for a credit hour carrying the grade of II, 3 points for an hour's grade of III, 2 points for an hour's grade of IV, 1 point for an hour's grade of V, and nothing for a failure. This system, in which the numerical index of a student's standing is weighted by the hours of work carried as well as the grade obtained, has been used by the registrar's office in many of its computations of fraternity grade standings. At the University of Oregon the standing of the fraternities and halls of residence is published not only in the college daily but in the press generally throughout the state. At the end of each quarter, also, the registrar prints and distributes the name and standing of each student for each subject he has taken. This publication is, of course, viewed with great interest by all when it appears. Such publicity has undoubtedly the effect of making the standing of the average student some criterian of his intellectual ability, and we are interested in this point.

Because we considered that the motivation and university environment of the woman student was somewhat different from that of the man student, we divided the data into three parts and obtained the correlation between the grade indexes of sisters and sisters, of brothers and brothers and of brothers and sisters; no pair of sibs appearing in more than one table. Equal numbers could not be secured because of a lack of male relatives. The statistical constants obtained are tabulated below.

A comparison of the means of the grade indexes exhibits the customary situation; the women grade higher than the men. This is explained, by the men, as being due to the greater docility and obedience of the human female, her ability in rote memorization, her shrewd choice of subjects which will not prove to be a menace to her scholastic pres-

| | *Means* | | *Std. dev.* | | *Coef. of correl.* | *No.* |
|---|---|---|---|---|---|---|
| | 1 | 2 | 1 | 2 | 1 and2 | |
| Sisters | 1.41±.04 | 1.44±.05 | .36±.03 | .43±.03 | +.61±.07 | 38. |
| Brothers | 1.27±.09 | 1.23±.07 | .66±.06 | .52±.05 | +.74±.06 | 26. |
| Brothers and Sisters | 1.15±.04 | 1.32±.04 | .34±.03 | .34±.03 | +.04±.11 | 36. |

tige, and the disinclination of male instructors to believe that woman students are as stupid as their answers to questions suggest. Nevertheless the fact of superior standing remains, and the woman student has her own explanation of it. The coefficients of correlation are all positive, two are very high, while one, that between the scholastic indexes of brothers and sisters, is statistically non-significant. We suggest that a somewhat lower coefficient is to be expected in correlating grades produced by students of different sex, for brothers are more liable than their sisters to be partially self-supporting and more liable to be interested in athletics. At the same time we expected the brother-sister correlation to be higher than it is. We cannot account for the high standard deviations in the all-brother grades.

### Non-Hereditary Factors

It is perhaps worthwhile, at the risk of introducing more discussion than the figures which we have to present warrant, to make some comment upon circumstances of a non-hereditary nature which would account to some extent for similarity in the standing of related students. The high school preparation differs in different parts of the state, and relatives would probably attend the same school. Much of this inequality should be over by the sophomore year.

In those rare cases in which courses were taken together brothers or sisters would do their preparation together. Then, an instructor might be prejudiced in favor of or against a student because of a prior experience with a brother or sister and really grade the family reputation.

As a matter of probability it seems difficult to believe that these non-hereditary factors would of themselves produce large positive coefficients. The smallness of the number of students involved necessitates caution and our conclusion is that some inheritance of a grade-getting aptitude is indicated by the figures presented. The results and conclusion are in accord with prior work both in England and the United States upon this same subject.

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# IMPROVEMENT OF THE PIGEON PEA

## Genetic Analysis of *Cajanus indicus* and the Creation of New Varieties through Hybridization and Selection*

F. G. KRAUSS
*Professor of Agronomy, University of Hawaii*

**HYBRID PIGEON PEA**

**Figure 15**

New hybrid variety "New Era, Strain X" Developed at University Farm, University of Hawaii, Honolulu T. H. At the time this plant was photographed it was exactly one year old and had produced 6,460 perfect seeds with some pods still remaining. It had weathered one of the dryest years recorded in Honolulu in twenty years (15.37"). The soil upon which it is growing would not produce more than 35 bushels of corn per acre with irrigation. This plant, however, received neither irrigation nor cultivation, throughout its development.

THE tropical leguminous shrub, *Cajanus indicus*, commonly called the pigeon pea, lends itself admirably to genetic study and improvement through breeding. It consists of one variable species, subdivided

*Abstract of a talk before the Hawaiian Academy of Science, Honolulu, May 20, 1926.

TWO TYPES OF PIGEON PEAS

**Figure 16**

The pigeon pea consists of one variable species divided into two subspecies: *C. indicus flavus*, D. C. (left); and *C. indicus bicolor* (right). The former has yellow flowers, self colored seeds and pods; the latter, yellow flowers with back of standard red, speckled seeds, and pods blotched with maroon. Also, the foliage of the latter variety is larger than that of the former.

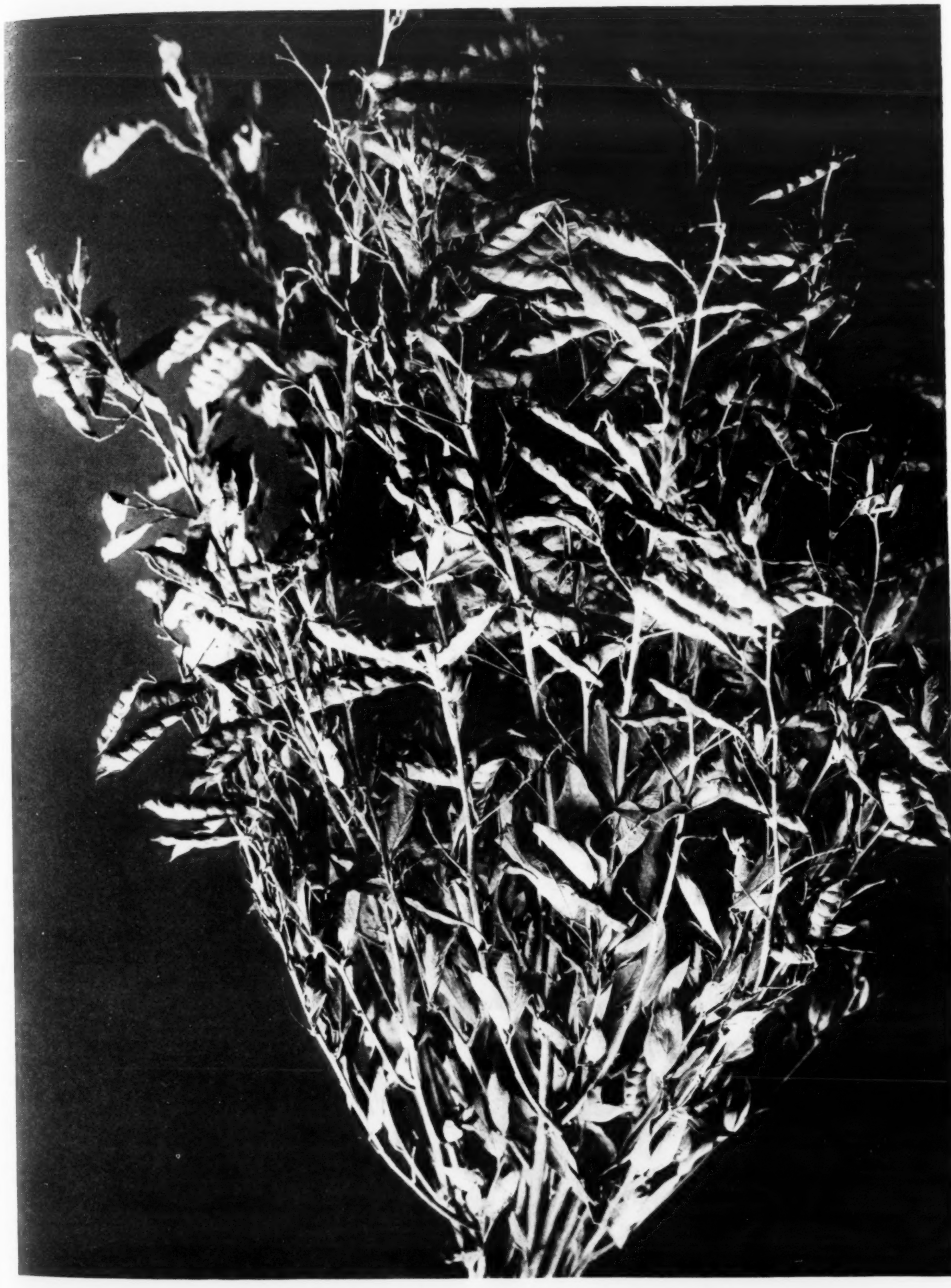

**Figure 16**

The pigeon pea consists of one variable species divided into two subspecies: *C. indicus flavus*, D. C. (left); and *C. indicus bicolor* (right). The former has yellow flowers, self colored seeds and pods; the latter, yellow flowers with back of standard red, speckled seeds, and pods blotched with maroon. Also, the foliage of the latter variety is larger than that of the former.



**FRUITING BRANCHES OF NEW ERA PEA**

**Figure 17**

Average growth and development of variety New Era Strain D, Early Maturing Heavy Seeding type. This variety produces two crops of seed per annum, beginning to bear at five to six months of age. Under favorable soil conditions the plants remain at their prime for five years, though there are fields at the Haiku Experiment Station nine years old. This variety has maintained and fattened one to two cattle per acre throughout the year and has produced 500 to 1,000 pounds of beef (live weight) per acre per annum. Cattle make gains of 2 to 3 pounds per day on prime peas.

**BREEDING PLOTS OF PIGEON PEAS**

**Figure 18**

New Era Homestead Farms, Haiku, Island of Maui, Hawaii. (Under the auspices of the Hawaii [U. S.] Agricultural Experiment Station). Multiplying of the New Era Strain D. $F_5$ progeny from original single mother plant. Yielding three to four thousand-fold in seed.

New Era Homestead Farms, Haiku, Island of Maui, Hawaii. (Under the auspices of the Hawaii [U. S.] Agricultural Experiment Station).
Multiplying of the New Era Strain D. $F_3$ progeny from original single mother plant. Yielding three to four thousand-fold in seed.

**Figure 18**

## PURE PARENTS AND HYBRID CAJANUS

**Figure 19**

$F_1$ of a cross between supposedly pure strains of *Cajanus indicus flavus*, variety No. 218♀, (1) × *C. indicus bicolor*, variety No. 219♂, (3). Remaining types are $F_1$ hybrid progeny of the parents indicated. All progeny inherit the bicolored flowers, pubescent and blotched pods, etc., as dominant characters. Segregation and recombinations occur freely in subsequent generations adhering closely to the Mendelian ratios.

into (a) *C. flavus,* D. C., which has yellow flowers, self-colored seeds and pods, the latter glabrous; and (b) *C. bicolor,* D. C., yellow flowered with back of standard red, seeds speckled, pods blotched with maroon, surface pubescent. The varieties vary greatly in general habits of growth and in their inflorescence, seed, and pod characters.

### Allelomorphic Characters

Insofar as the inheritance of the main characters has been studied in a number of pure line varieties, some characters, at least, definitely follow the mendelian law.—Red flower standards are dominant over yellow, blotched or speckled seeds dominate over self-colored, and maroon, blotched pods are dominant over self-colored light tinted. Pubescent pods are dominant over glabrous. Large flat pods are dominant over small round pods, large seeds over small seeds. Four and five seeded pods are dominant over three and four seeded pods. Round seeds, slightly flattened, dominate over all others of widely different shapes and forms, such as spherical, oval, flattened, irregular, etc. Axillary flowers and pods dominate over those located in the terminal inflorescence. In stature there is a tendency toward blended inheritance in that the crossing of very dwarf varieties with very tall varieties tends to produce an intermediate type, but crossing two tall types almost invariably produces a form taller than either parent. Crossing an annual type on a perennial type appears to produce perennial forms. Insofar as reciprocal crosses have been studied, the above behavior remains constant in that practically complete dominance for some well defined differentiating unit character is the rule. Although, as has been noted, there appears to be some blended (more or less intermediate) inheritance, as when red colored dorsal standard sorts were crossed with red types, the solid red gives way to red lacing, and when extremely tall and dwarf forms were crossed, the $F_1$ gave intermediate stature. Wherever dominance is apparent, $F_2$ shows fairly definite mendelian segregation as well as definite linkage between some characters.

### New Varieties

Dihybrid crosses thus far studied appear to adhere rather closely to the 9—3—3—1 ratio, as was to be expected. In any event, the work has progressed sufficiently that there has now been bred and established a new hybrid form which incorporates many of the desirable qualities which were definitely sought after. This new creation in Cajanus, for the present designated as *"New Era, Strain X",* is characterized by its strong upright growth, and deeply penetrative tap-root, reasonably early maturity and extraordinarily heavy seed production. The production record of the original mother plant of this new hybrid is as follows:

*Performance Record (1st Year) Cajanus Indicus Hybrid, New Era, Strain X,* 1925. *(Original Mother Plant.)*

| | |
|---|---|
| Number of pods | 1430 |
| Weight of pods (in seed) | 1587 grams |
| Weight of seeds | 1150 grams |
| Percentage weight seeds to pod | 73 per cent |
| Number of seeds per pod | 4.6 |
| Total number of seeds produced | 6460 |

In other words, one seed reproduced itself 6,460 fold in one season! Is there any other economic crop plant that has thus far equalled this record? We should like to hear from agronomists concerning this.

We have now every reason to believe that we are entering upon a clear conception of the hereditary behavior of *Cajanus indicus* to an extent that will enable us to apply the new science of genetics to practical and far reaching purposes in tropical agriculture. Should we succeed, as we believe there is good reason to hope we shall, a hardy type of this valuable, but little known legume will eventually be produced in progenies resulting from crosses between the old established pure strain *New Era "D"* and hardy Himalyan types which thrive up to 6,000 feet altitude. Then will Hawaii have contributed not only to the tropical agricultural world, but likewise to the vast temperate zone agriculture a field crop second to none in the value and diversity of its economic uses.

# AN INTERESTING LILY HYBRID

DAVID GRIFFITHS
*U. S. Department of Agriculture*

**PARENT AND HYBRID COMPARED**

**Figure 20**

At left are plants of *L. concolor*, with nearly matured seed capsules. At right are the taller plants of the hybrid, just coming into flower. These were propagated from a single bulb, the only seedling of its kind in over a thousand raised from cross pollinated seed, and the only one that did not exhibit straight maternal inheritance. This unexpected hybrid has a number of desirable characteristics, and if it becomes popular it will be another posthumous gift of the great plant breeder, Dr. Walter Van Fleet, who made the cross.

LATE in the autumn of 1921 my friend and associate, the late Dr. Walter Van Fleet, brought into my office, according to a previous promise, his crop of seed of two lilies—*Lilium tenuifolium* and *L. concolor*. He had two small paper bags of pods which may have yielded a total of an ounce or

more of clean seed, some of which was light and more than likely would not grow.

I had visited his grounds the previous summer and expressed a desire to get up some stock of both of these species, and he had volunteered to save the seed for me. The packages were marked *L. tenuifolium* × *L. concolor*, and *L. concolor* × *L. tenuifolium*. I expressed some surprise at receiving hybrid seed.

The Doctor became rather embarrassed but finally hesitatingly and modestly apologized for not being able to resist the temptation of crossing these two lilies again this year, as he had done two or three times before. He assured me, however, that I would get only "straight" seedlings for he had previously grown two such reciprocal crosses to maturity and had always gotten nothing but maternal inheritance. In one single seedling he thought he detected slightly increased vigor but nothing more.

The seed was sent to Bellingham, Washington, and planted immediately. It germinated in the spring and was left two seasons in the seed bed. Owing to the inroads of Chinese pheasants many *tenuifolium* seedlings were destroyed, but a larger quantity of the *concolor* reached maturity.

All the seedlings were dug in the fall of 1923 and again in 1925. Again there was noticed only maternal inheritance, but at the digging in 1925 there was noted one large symmetrical bulb which put me in mind of the bulb of the dwarf *L. tigrinum* in the otherwise uniform *concolor* stock. This bulb was easily separable into six angular divisions. These were planted side by side in a part of a row. In 1926 these all blossomed and showed unmistakable evidence of hybridity. If stock can be worked up this hybrid will be as desirable as the popular *L. tenuifolium*.

The lily is best described as a robust *L. concolor* with the inflorescence of *L. tenuifolium*. It blossoms fully a month later than either parent. In color of flower, as nearly as I could tell from memory, it is closer to *L. concolor*, but identical with neither parent. In 1926 it blossomed August 15, but the season was an erratic one in which most lilies blossomed early.

The cross is of special interest in that it is between two quite divergent sections of a genus which, as a whole, has been rather stubborn in yielding hybrid progeny. It is of particular interest that no other variant has been observed in the two progenies of close to 1,000 bulbs, nor in the two previous reciprocal crosses grown by the Doctor himself with but one doubtful, slight variation.

The incident bears, in company with other lily crosses, a further confirmation of the desirability of large progenies when hybridizing lilies.

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## The Right Child in the Right School

PROBLEMS DER SCHUELERAUSLESE, *by* WILLIAM STERN. Pp. 50, price 35c. Verlag Quelle & Meyer in Leipzig, Germany.

In this address the Hamburg psychologist considers inborn differences in children, and the way in which they may be utilized to the best advantage of the individual and the state. Education must be adapted to talent and inclination, and Germany, like America, has already taken long steps toward making the schools more adaptable, so that the bright child does not have to drag along in lockstep with the moron. But the problem of selecting, skilfully and at the proper time, the pupil who should be allowed or obliged to hasten his pace, has not yet been dealt with so fully. Professor Stern argues that the teachers' judgments are not sufficient, and that tests of intelligence and aptitude must be relied on to supplement and correct such judgments. The address deals in a broad and philosophical, yet practical way with some of the fundamental problems of eugenics.

*P. P.*

# MAN--THE TIME BINDER

## Alice in Wonderland Pursues "Logical Destiny"

"KNOW thyself" said the Greek philosopher, and promptly proceeded to spin a cocoon of words, from which his intellectual descendants have periodically been hatching metaphysical butterflies. That these did not have much resemblance to man as he is, is not to be wondered at, for which Amoeba was to blame as we learn in the quotation with which Polakov's entertaining book* opens:

"Realize thyself, Amoeba dear," said Will: and Amoeba realized herself, and there was no small Change but many Checks on the Bank wherein the wild Time grew and grew and grew. And in the latter days Homo appeared. How, he knew not; and Homo called the change Progress, and the How he called God. . . . for speech was ever a comforter. And when Homo came to study the parts of speech, he wove himself a noose of Words. And he hearkened to himself, and bowed his head and made abstractions hypostatized and glorified: and the children did after the manner of their fathers for so had they been taught. And last of all Homo began to eat his words.

Now, after much time, there appeared Reason, which said, "Wherefore hast thou done this thing?"

And Homo said "Speech betrayed me."

To whom Reason: "Go to now and seek the Doctrine of Symbolism which showeth that the bee buzzeth not in the Head but in the Bonnet."

But Homo hearkened not, and his sin was the greater in that he was proud and obstinate withal. For as Philosopher and Economist he said—"We will tend to give the matter our careful consideration." And as Returning Warrior, he asked: "What grannie, didst thou say in the Great Wars?" And as Plain Man he continued to splash solemnly about in the Vocabulary of Ambiguity—and all the while the Noose was tightening and Homo began to grow inarticulate.† . . . .

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### Man's View of Man

"Ah, what is it now?" the Unicorn cried, eagerly. "You'll never guess! *I* couldn't."

The Lion looked at Alice wearily. Are you animal—or vegetable—or mineral?" he said, yawning at every other word.

"It's a fabulous monster!" said the Unicorn, before Alice could reply.

Polakov believes that most of the difficulties the human race has encountered in the past are to be traced to the fact that man's concepts of his place in nature have been wrong. Reason, Homo, and Will have gotten things into such a mess that man thinks of himself as neither fish, flesh, nor fowl, and tries to act like all three. As a matter of fact he is a distinct order of nature due to his unique "time binding" faculty, which makes it possible for each succeeding generation to build on dead men's shoulders. The author is convinced that a revision and rationalization of man's concept of himself, in the light of his "time binding" propensities is only necessary to usher in the Millenium:

Both the theological conception of man as a being endowed with a supernatural "Spark" on the one side, and the zoological or biological conception of man as a specie of animal on the other, appeared as empty phantoms in the light of mathematical logic. There was no discovery of anything hitherto unknown; it was only an irrefutable demonstration that old explanations explain nothing. The old theories of man were unable to account for his conduct, and incapable of foretelling his actions. It has been known for ages, but remained largely misunderstood until recent destruction of old idols made it imperative for us to reconstruct our entire world-view. . . .

. . . . The concept of man as an animal freed man from superstitions of the past and gave free reign to his search into his bodily functions, including the chemistry of thoughts and emotions. The great shortcoming of this point of view was that man applied to himself an argumentative, speculative method of primitive Aristotelian logic. . . . .

*POLAKOV, WALTER. Man and His Affairs, from an Engineering Point of View. Pp. 233, price, $2.50, Williams and Wilkins, Baltimore, 1926.

†OGDEN and RICHARDS. The Meaning of Meaning. Harcourt Brace and Company, New York, 1924.

. . . . Because of this unique ability [the so-called time-binding property which distinguishes man from other living forms] of the human class of life to accumulate the knowledge collected in the past by his ancestors, no matter how remote and by virtue of this cumulative knowledge to change the speed of events, man finally came to realize his double relation to the universe. On one side he is a part of the universe, is subject to its natural law and is the object of observations (observed) while on the other hand he is himself the "observer" and the critic of himself and of his observations about himself. In other words man came to realize that one thing is what man is and another is *what he thinks he is.* What man is, is a constant factor; what man thinks himself to be is a variable factor as we have already seen. The results of these two factors, of course, is also variable and, as history teaches us, the product of these two factors is very different depending on the kind of notion man has about himself. When man regards himself as an animal, our civilization is bound to be animalistic and man acts as a beast, or rather, as he thinks the beast should act.

Now, animals are conservative because they are living on what they can get of the free gifts of nature. They repeat their acts in a predetermined manner, and are devoid of reasoning power. Hence man believing himself to be an animal, glorifies conservatism and passes laws that fix certain conduct and organization as unchangeable; moreover reason, criticism and the ability to improve being unessential for the preservation of the life of animals, is neglected, suppressed or even persecuted in any human society whenever it believes itself to be animalistic society. What are the results?

. . . . From time to time in human history we observe revolts. Men revolt against fixed, established, legalized conditions and relations, demanding and perforce introducing changes. Why?

Man's knowledge grows at a rapid rate; his knowledge creates new situations; new conditions make old fixed laws intolerable; their preservation becomes a crime against human nature and conflicts are bound to come whenever that part of society which believes that man is an animal, insists on the preservation of laws and organization which were perhaps suitable yesterday, but are out-distanced today. When force is used to stem the tide of human progress, the force of the time-binding power breaks all resistance as surely as any force that accumulates faster than the resisting force.

This law of human nature is wonderful. To study and to discover the nature and the laws of man's time-binding energies, is to discover the laws of human nature, and as Keyser says: "It is a scientific task of supreme importance, for it is evident that upon the natural laws of time-binding must be based the future science and art of human life and human welfare."

## Concealing Our Thoughts

The principal stumbling block to the rationalization of man's place in nature is the state in which these Three Horsemen of the Unabridged, Homo, Reason, and Will, have left our language. To get rid of these difficulties we have first to revise the currency of our speech. "The whole function of our language is to have meaning," but this is not true of much that is said and written today, for the words we utter may transmit facts, phantasies, or inanities—often we are at a loss to decide which:

Thus we should bear in mind that our language, while it is a unique human tool for transmitting knowledge from the past through the present into the future, is not only a transmitter of time-binding power but frequently acts as a destructive or at least retarding agent of human progress.

Speaking of this function of language, Professor Keyser in his review of Ogden and Richards' book clearly stated that: "language is not only the most powerful of agencies for the maintenance and advancement of civilization, but it is also the most powerful agency for destroying and retarding it. Regarding the latter aspect of language it is safe to say that hardly one in a thousand "educated" people, to say nothing of others, has so much as glimmering of the magnitude and subtelv of the baneful effects that have resulted and continue to result alike from cunning abuse and from ignorant use of verbal symbolism. Those who would but care to familiarize themselves with the evidence collected by these authors will be amazed at the extent to which in religion, in philosophy, in theology, in politics and in science, whole nations and peoples East and West have been, through the ages, and still are, unconscious victims of "verbomania."

. . . . The sarcastic remark of Taine that we use language to conceal our thoughts is often true, but it is more frequent that this concealment of thought is quite unintentional, or, in other words, we often make meaningless statements because we have no thoughts and want to conceal not thoughts but absence of them.

Present-day language is overburdened with words that do not correspond any longer to any entity or perhaps they never did.

since words are merely objectified abstractions and these abstractions are often not true to fact. In this way we were led to create "bogus entities" but, not being clearly aware of it, we mistake them for something that has either physical or logical existence and pay a dear price for striving and fighting for what is not.

. . . . Now, I hope, it is fairly clear that in the branches of human engineering, such as politics, industrial management, domestic relations, pedagogy, etc., language and logic are of paramount importance. If we talk or write ambiguous language the outcome is bound to be either indefinite as in a sentence: "a hen-hawk caught a hen and killed her in her nest" (whose nest?) or simply nonsensical, as the expression: Sin 50+2 pounds =4 inches or: man=body+soul, (nonsense).

The triumph of logic as well as of language will be attained when we recognize the fallacy of a proposition as readily as the fallacy of a mathematical expression, i. e., by examining its form.

Once we grant Polakov's premises the rest is simple, but is his proposition *sense* or *non-sense?* In the first place, would it be possible to construct or reconstruct a foolproof language—one that can be depended on to transmit approximately the same meaning to everybody? Only a little carelessness or stupidity is sufficient to upset most of the engineers' foolproof machines. Imagine the size, watchfulness, and intelligence of the engineering staff that would be necessary to keep our model language in repair! Meanings change over night—words get wrapped around our heart-strings or around our vasomotor sympathetic systems (depending on whether one is a sentimentalist or a physiological psychologist), and the fat is in the fire again.

**The Mathematician and the Moron**

At the risk of being cast into the outer darkness among those who cannot reason from logical premises may we ask whether Polakov understands the complexity of his problem? "Logical destiny" as a Utopia may be better than some of the others, but is it any more easily attained? Whether Polakov likes it or not, our biological space-binding past must be counted in aeons, while our "time-binding" past is counted in centuries. Unlike "time-binding past" this is "active past" rather than "passive past." As "time-binders" we "climb on dead men's shoulders"; as the living descendants of millions of generations of "space-binders" we are guided somewhat by dead men's hands. The result is not logical sometimes—it is biological. Korzybski's time-binding formula,* which our author considers a revolutionary discovery, has only one biological factor, *R*, but this is the result of a multitude of variables. In the long run this would prove to fluctuate as always it has in the past, and as Polakov points out has been the case. Being an engineer he is to be excused for his simple faith that the fecund moron is to be metamorphosed into one of our childless intellectuals by so simple an expedient as wispering to him that he is a "Time-Binder" and that he has a "Logical Destiny." Neither is there much hope that shouting these tidings from the housetops will affect the mental status of the moronic offspring. Under present conditions intelligence appears to be almost a lethal factor, so

*$\frac{R}{R-I}$ (PRT-P), Where P= the state of development of the generation with which we begin our computation; R= the peculiar capacity of human beings to bind time; T= Number of generations. A majority of the footnotes in "Man and His Affairs" are quotations from "Alice in Wonderland." Under such topsy-turvy conditions this little group of symbols might be the answer to the enigmas of history and the key to all the future holds. We can imagine that the process would resolve itself into something like this:

"You're a Time Binder, you know," said Alice. And a Time Binder has a Logical Destiny. Since you have to admit that R over R minus one times PRT minus P represents the progress you *might* make, it's foolish for you to talk this nonsense."

And forthwith the Mad Hatter saned up and pursued his destiny logically the rest of his days, and his children after him to the third and fourth generation, when they had become so intelligent and so scarce that Alice had to start a new generation of Time Binders by repeating the formula to Tweedledum and Tweedledee.

rapidly do we eliminate the more intelligent members of society (or at least those who have the misfortune to get their intelligence cultivated). Can *R* remain constant under these conditions? If the elimination of intelligence is carried far enough, the whole time-binding structure is destroyed, and we have to begin over again.

"What man is is a constant factor"—does Polakov really believe this? Does he believe that the minds of the moron and of the genius are really the same? (Perhaps the definition of man rules out the moron, but in this case our definition soon gets us into absurdities). Are only those who can deal in mathematical abstractions to be admitted to the Society of Time Binders? A man would be a man at one time and not at others. Polakov makes the mistake of assuming that we think only with our "new brain"—the part of the brain that sets up apart as time-binders. The functions of the rest of our nervous system were not suspended when we reached the time-binder's estate. Some of these other activities of our minds are not logical, and yet they are very potent causes of what we do. They are certainly a part of man even though they may have no place in the economy of a mathematician bent on "Logical Destiny."

These rather näive assumptions of the simplicity of reorganizing human affairs should not blind us to the value of the time-binding concept of man. The view is undoubtedly stimulating, and it has peculiar eugenic significance—time binders should feel strongly the obligation of passing on the torch of knowledge brighter than before. We must realize, though, that no "Open Sesame" formula is likely to unlock all the secrets of human behavior. It is the tragedy of our specialized world that each of us is prone to consider his particular pass-word as the key. Especially this is so if he constructs his panacea by applying the principles of his specialty to another field. Educationalists, birth controllers, philanthropists, wets and drys, and ists and isms of many kinds—each has his own magic formula. Many of them may be absurd—they are all inadequate—even the solution of drilling into our heads that we are "time binders" and must behave accordingly.

*Robert Cook.*

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## A Biological Rip Van Winkle

LE HARAS HUMAIN. DR. BINET-SANGLE. Albin Michel, Paris. Second edition, 1926.

If some not too critical biologist, having dozed off in the latter half of the nineteenth century, should awaken at the present time, take a hasty glance about him and then write a book, the volume might have much in common with *Le Haras Humain*. Here one may find ideas of fifty years ago presented in a scanty drapery of modern thought. The regular inheritance of acquired characters is taken for granted, the reality of telegony is vouched for, the importance of "prenatal influence" is emphasized—and everything is explained on the theory of pangenesis. Each cell is said to give off myriads of particles into the circulating fluid. These "corpuscles are called 'gemmules' by Charles Darwin, . . . 'genes' by Th. Morgan." (p. 38.) The reader is given no hint that any of the dicta may be open to question, except that it is intimated (p. 49) that some persons "poor in ideophoric neurones" have doubted the reality of the homonculus. In the treatment of sociological aspects of his subject the author is scarcely more fortunate. The book contains a considerable number of interesting pedigrees of superior families which are not often included in English and American treatises.

*C. H. D.*